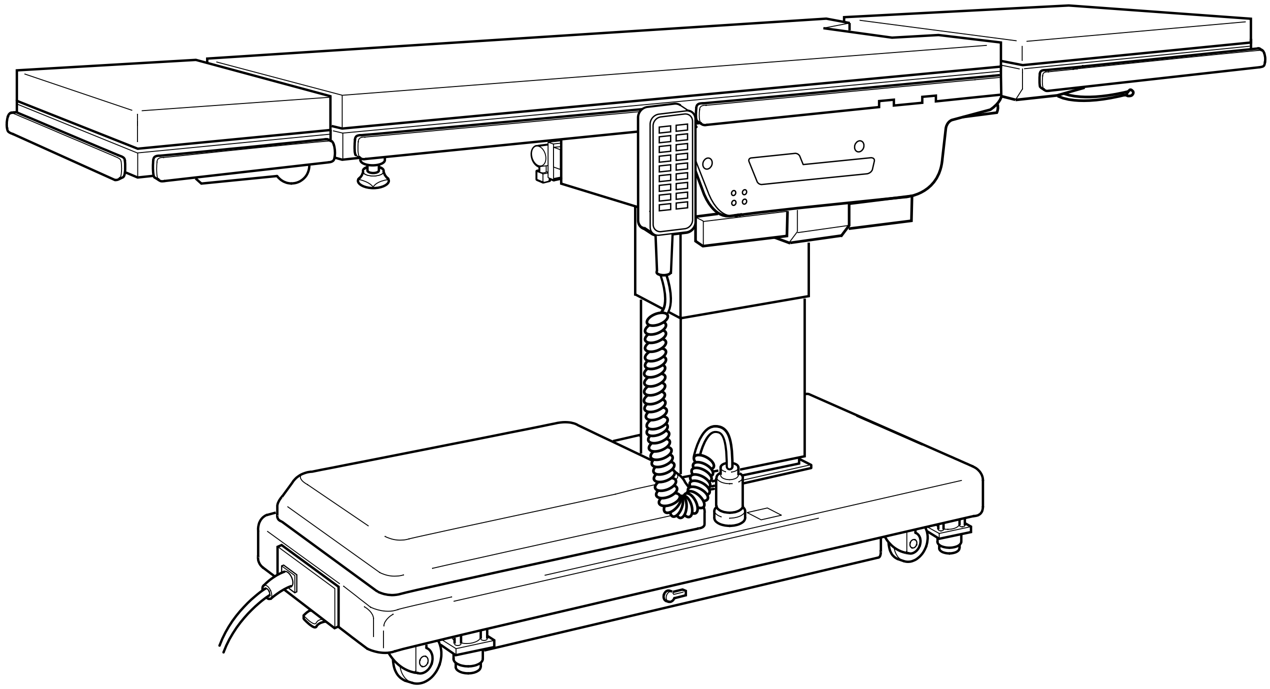
ELITE SERIES SURGICAL TABLES
MAINTENANCE MANUAL



MODEL ELITE 3500 AND 3500B

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SECTION I HYDRAULIC SYSTEM

1-1. General

Electro-Hydraulic System

The hydraulic system (with the exception of the hydraulic cylinders and hoses) is contained within the base of the table. The hydraulic valves and pump are electrically controlled by the use of a hand-held push button pendant control. The power requirements for the table are 120 VAC, 5 amp, 60 Hz.

The table contains the following components. Refer to the block diagram (figure 1-1) for relationship.

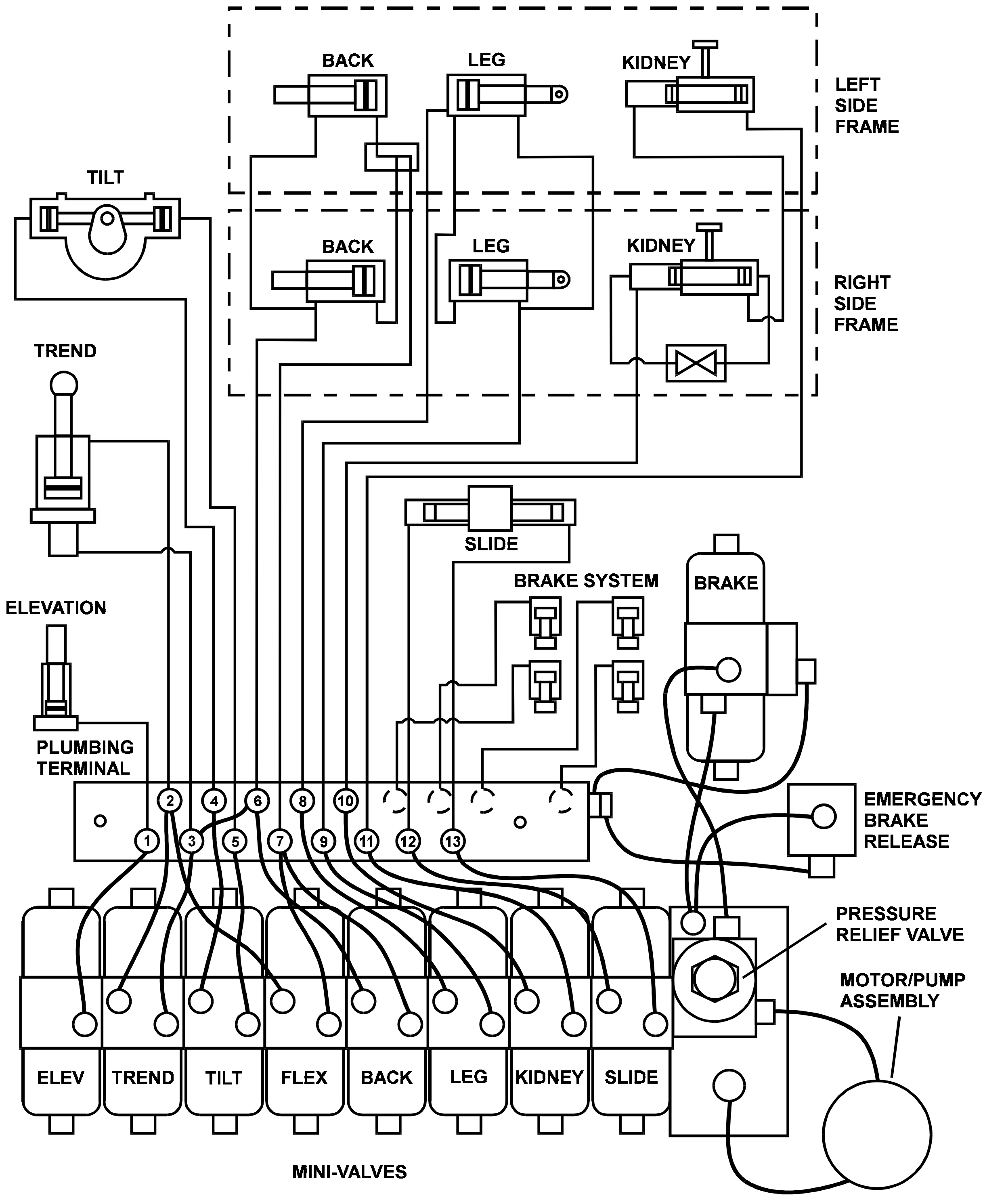


Figure 1-1. Hydraulic Block Diagram

a. Oil Reservoir - Main oil supply. Approximately two quarts.

b. Motor/Pump Assembly - A positive displacement gear type pump provides the necessary oil pressure and volume.

c. Pressure Relief Valve - Provides an alternate oil path when the hydraulic cylinders reach the end of their stroke.

d. Electro/Hydraulic Mini-Valve Assemblies -These direct the fluid to the appropriate hydraulic cylinders.

e. Hydraulic Lines, Fittings, Connections - They provide a path for the hydraulic oil.

f. Hydraulic Cylinders - They convert the hydraulic fluid pressure and volume into mechanical motion.

1-2. Component Operation

a. Motor/Pump Operation

The motor/pump assembly is a gear type pump that provides the oil pressure and volume for the entire hydraulic system. The pump has an inlet side and an outlet side. The inlet side is connected to the reservoir which provides the oil supply. The reservoir has a very fine mesh screen strainer which prevents foreign material from entering the oil system.

The output line of the pump is connected to the main oil galley which is internal and common to all the hydraulic mini-valves and pressure relief valve. Also, common to the hydraulic mini-valves and pressure relief valve is an oil galley that internally connects to the oil reservoir to provide a return path for the hydraulic oil. See figure 1-2.

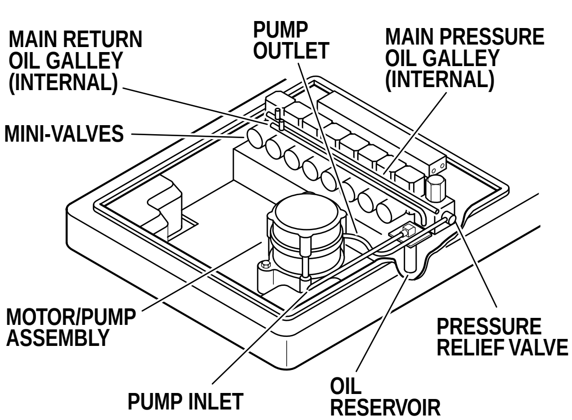


Figure 1-2.

b. Pressure Relief Valve

This device provides an alternate oil path when the hydraulic cylinders reach the end of their stroke and the pump continues to run. If this path were not provided, the pump motor would stall because the oil cannot be compressed. The pressure relief valve is directly connected to the mini-valve bodies and shares both the common internal main pressure oil galley, and the return oil galley, that internally connect to the reservoir.

The main component of the valve is an adjustable spring loaded plunger that is pushed off from its seat by the oil pressure. The oil then flows back into the reservoir. Turning the adjustment nut clockwise increases the amount of oil pressure required to open the valve, and turning it counterclockwise decreases the amount of oil pressure. (See adjustment section for specification.)

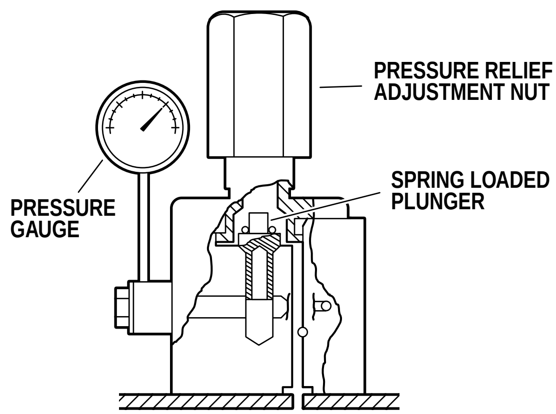


Figure 1-3. Pressure Relief Valve Not Functioning

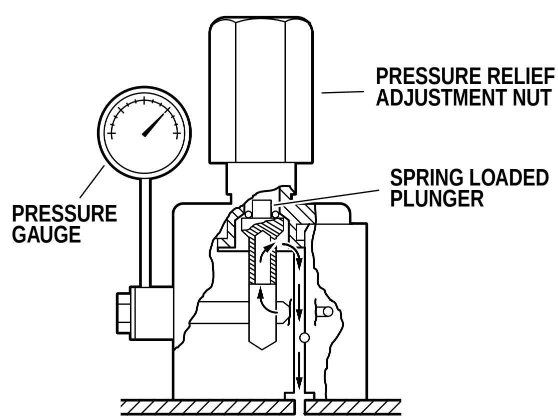


Figure 1-4. Pressure Relief Valve Functioning

c. Mini-Valves

The operation of the mini-valves is identical for all table functions except the elevation and Single Action Brake circuits. These two hydraulic circuits use a 3-way (single check valve) type mini-valve. All other functions use a 4-way (dual check valve) type mini-valve.

Either type mini-valve is controlled by two pushing type, electrically operated solenoids. The solenoids push the spool valve (located in the lower portion of the valve) one way or the other. This motion opens the main supply galley (which has pump pressure) allowing the oil to flow through the various parts of the mini-valve to the function. The spool valve also opens an oil return circuit which allows the oil to return to the oil reservoir.

The main components of the mini-valve and their functions are listed below:

1. Spool Valve - Opens the main oil galley (pump pressure) to either mini-valve outlet depending on which direction the spool valve is pushed. Also it provides a return path for the oil returning back into the reservoir.

2. Pilot Plunger - There are two plungers in a four-way mini-valve (one in a 3-way mini-valve), one under each check valve. The purpose of the pilot plungers is to mechanically open the return check valve allowing the oil to return back into the reservoir.

3. Check Valve - Two are provided in each four-way mini-valve to seal the oil in the cylinders and oil lines and prevent any movement of the table. One check valve is provided in a 3-way mini-valve.

4. Speed Adjustments - There are two speed adjustments in each mini-valve. They are needle valve type controls which restrict the volume of oil returning back into the reservoir, thereby controlling the speed of the table surface movement. A 3-way mini-valve has only one speed adjustment.

The speed controls are always located in the return oil circuit. This prevents uncontrolled movement of the piston in the slave cylinder due to one side of the piston being loaded with hydraulic pressure and the other side having no load.

Also, by using this control method, it doesn't matter what size cylinder and piston is used because the speed can be controlled by restricting the return oil. If the pump puts out more volume to a certain slave cylinder than the speed control is allowing to go back to the reservoir, the pressure relief valve provides an alternate path for the pump oil.

d. Mini-Valve in Neutral Position

(No fluid flow) See figure 1-5.

1. Spool Valve Centered - This closes off both oil pressure and oil return galleys.

2. Pilot Plungers Both Closed -The pilot plungers control the opening of the check valves. If they are closed, the check valves must be closed.

3. Check Valves - Both check valves are closed trapping the oil in the cylinder and oil lines.

4. Speed Adjustment - When the mini-valve is in the neutral position, the speed adjustment does not affect anything because there is not any oil flow.

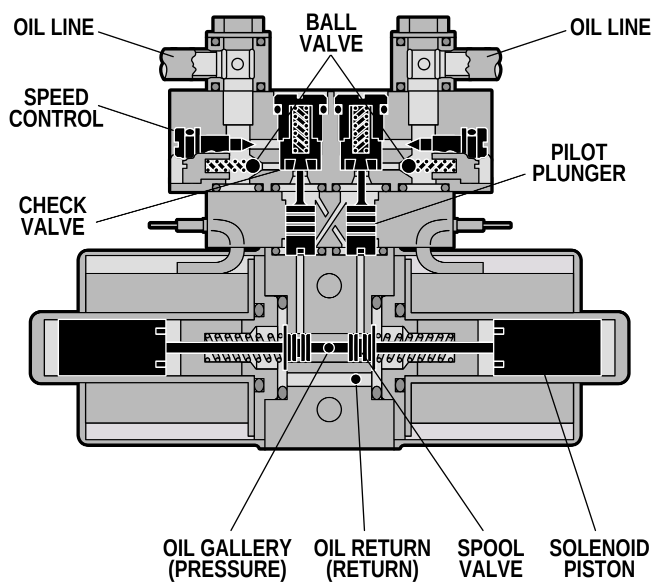


Figure 1-5. Mini-Valve in Neutral Position

e. Mini-Valve Right Port Activated
(See figure 1-6)
Slave Cylinder Piston Moves to Left
Right Mini-Valve Port is Supply Line
Left Mini-Valve Port is Return Line

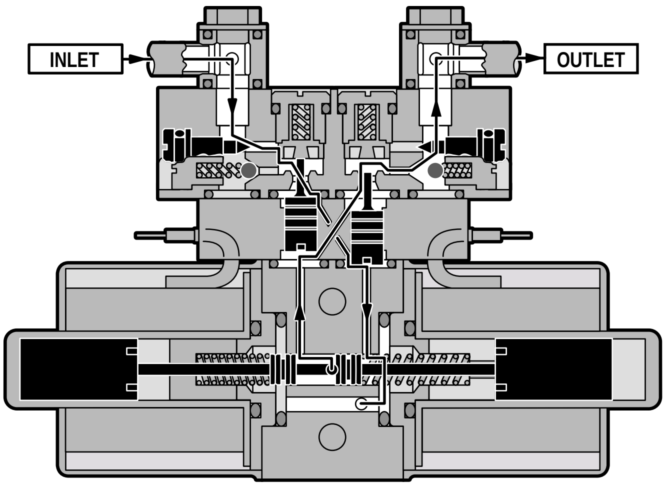


Figure 1-6. Mini-Valve Right Port Activated

1. Spool Valve - Pushed to the left by electric solenoid. This opens the internal oil pressure galley allowing the fluid to go through the check valve and on to the cylinder. Also, the spool valve opens the oil return line providing an oil path through the internal oil galley back to the reservoir.

2. Pilot Plunger Valve - Left pilot plunger valve is pushed up by the incoming oil pressure mechanically opening the check valve located above it in the return circuit. This action allows the oil from the left side of the slave cylinder to go back into the reservoir. The right pilot plunger valve is not affected in this operation mode.

3. Check Valves - Both check valves are opened in this operation mode. The right check valve is pushed open by the oil pressure created by the pump. The oil then continues to go through the lines and pushes the slave cylinder piston to the left. At the same time, the left check valve is held open mechanically by the pilot plunger providing a return path for the oil through the mini-valve back to the reservoir.

4. Speed Adjustment - The right speed control (output side) does not have any effect in this operation mode because the oil is routed around the speed adjustment through a by-pass valve and then to the output port. The left speed adjustment controls the speed of the table function by restricting the amount of oil going back into the reservoir.

f. Mini-Valve Left Port Activated
(See figure 1-7.)
Slave Cylinder Piston Moves to Right
Left Mini-Valve Port is Supply Line
Right Mini-Valve Port is Return Line

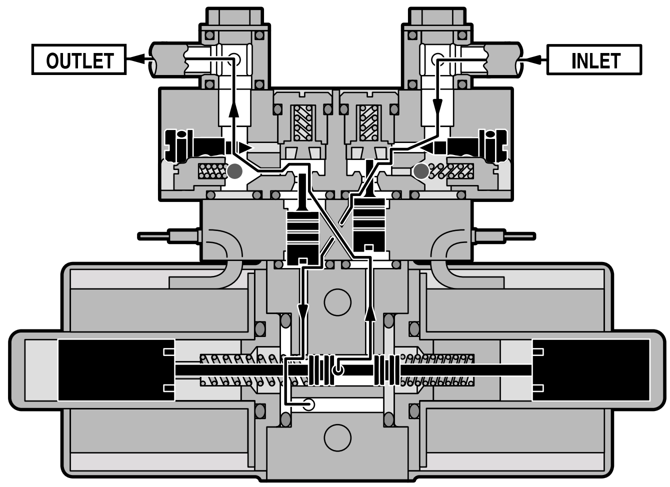


Figure 1-7 Mini-Valve Left Port Activated

1. Spool Valve -Pushed to the right by electric solenoid. This opens the internal oil pressure galley allowing the fluid to go through the check valve and on to the cylinder. Also, the spool valve opens the oil return line providing an oil path through the internal oil galley back to the reservoir.

2. Pilot Plunger Valve - Right pilot plunger valve is pushed up by the incoming oil pressure mechanically opening the check valve located above it in the return circuit. This action allows the oil from the right side of the slave cylinder to go back into the reservoir. The left pilot plunger valve is not affected in this operation mode.

3. Check Valves - Both check valves are opened in this operation mode. The left valve is pushed open by the oil pressure created by the pump. The oil then continues to go through the lines and pushes the slave cylinder piston to the right. At the same time, the right check valve is held open mechanically by the pilot plunger providing a return path for the oil through the mini-valve back to the reservoir.

4. Speed Adjustment - The left speed control (output side) does not have any effect in this operation mode because the oil is routed around the speed adjustment through a by-pass valve and then to the output port. The right speed adjustment controls the speed of the table function by restricting the amount of oil going back to the reservoir.

g. Hydraulic Cylinders (Slave Cylinders)

There are several different types of hydraulic cylinders used in the table that activate the control functions. With the exception of the elevation and brake cylinders, all operate basically the same way. The control functions are listed below: (See figure 1-8.).

Trendelenburg--1, double action cylinder
Back Section--2, double action cylinders
Leg Section--2, double action cylinders
Slide--1, double action cylinder
Kidney Lift--2, double action cylinders
Lateral Tilt--1, double action cylinder
Elevation--1, single action cylinder
Brakes--4, single action cylinders

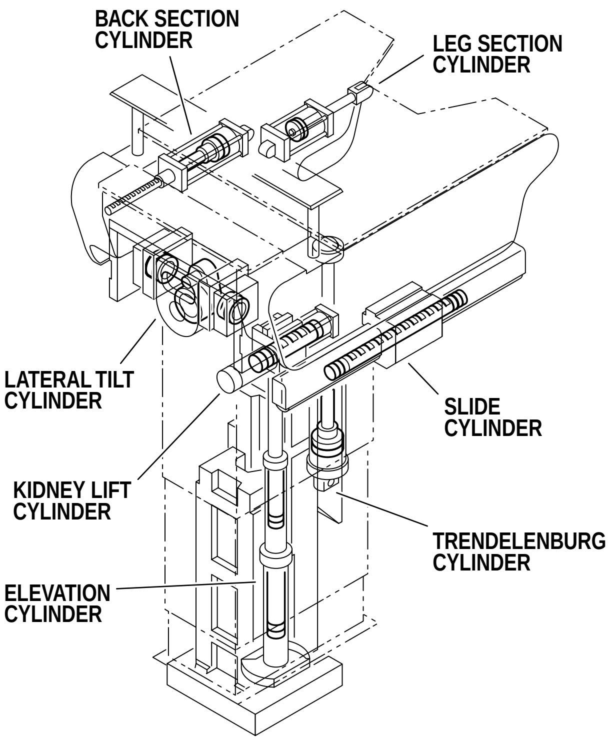


Figure 1-8. Cylinder Placement

1. Trendelenburg, Back Section and Leg Section Cylinders - The double action cylinders are closed at one end and have a movable piston with hydraulic fluid on both sides. Connected to this piston is a ram or shaft that exits out of the other end of the cylinder. Through the use of either a ball and socket, a gear, or clevis and pin arrangement, the ram is connected to a movable table surface.
The movable surface can be moved one way or the other by pumping hydraulic fluid into the cylinder on either side of the piston. Obviously, if oil is pumped into one side of the cylinder, a return path must be provided for the oil on the other side. See figure 1-9.

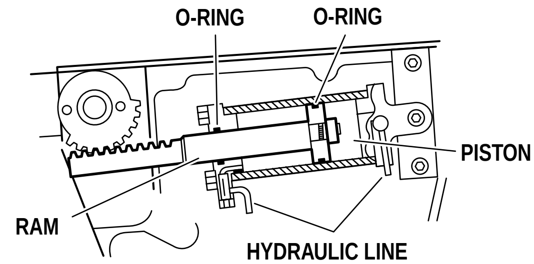


Figure 1-9. Back Section Cylinder

2. Slide Cylinder Assembly - This cylinder arrangement has two pistons, one on each end of a ram which has rack gear teeth cut into its top surface. These teeth mesh with a gear arrangement that drives a rack gear connected to the bottom of the side frame.
When hydraulic fluid is pumped into one side of the cylinder, the pistons are pushed in one direction, the gear arrangement rotates and causes the table top to slide. Oil pressure can be applied to either piston, making the table slide end for end. See figure 1-10.

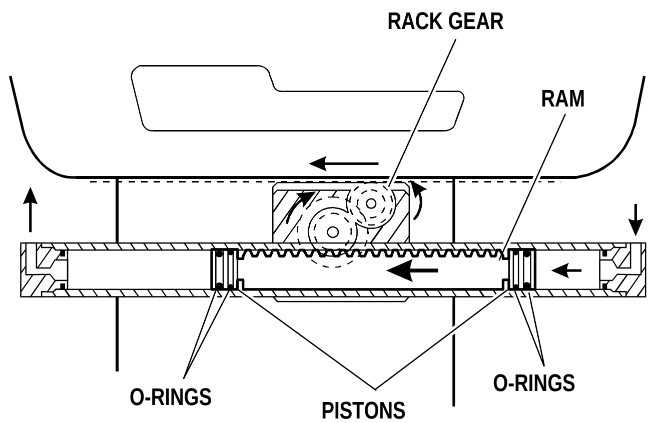


Figure 1-10. Slide Cylinder Assy.

3. Kidney Lift Cylinders - The two kidney lift cylinders are similar to the slide cylinder in that the ram has rack gear teeth cut into the top surface. O-Rings on each end of the ram allow the ram to also serve as the pistons.
The rack teeth cut into the top of the ram meshes with a pinion gear. This gear meshes with other gears to supply the up or down drive for the kidney lift bars, depending on which direction the oil is pumped into the cylinder. See figure 1-11.

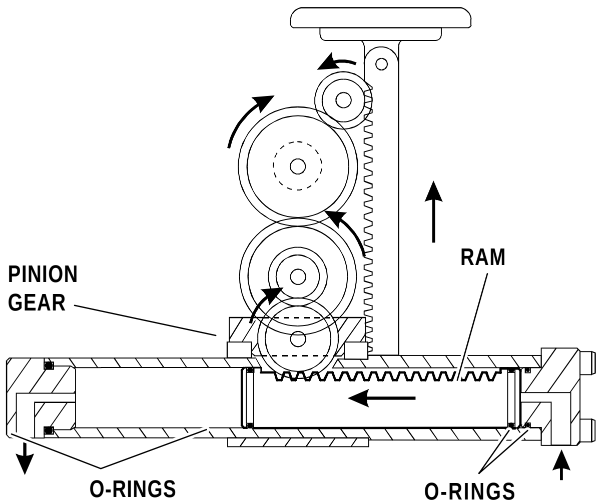


Figure 1-11. Kidney Lift Cylinder Assembly

4. Lateral Tilt Assembly - The lateral tilt assembly consists of two cylinders, pistons and connecting rods. The connecting rods attach to the lateral tilt lever which connects to the table center column assembly. The cylinder housing attaches to the table top and is attached to the center column assembly by pivots. See figure 1-12.
The pistons and connecting rods are attached to a non-movable surface. Therefore, when hydraulic fluid is pumped into one side, the cylinder housing itself moves around the lateral tilt lever causing the table top to tilt to one side.
To tilt the table top in the opposite direction, fluid is pumped into the opposite cylinder.

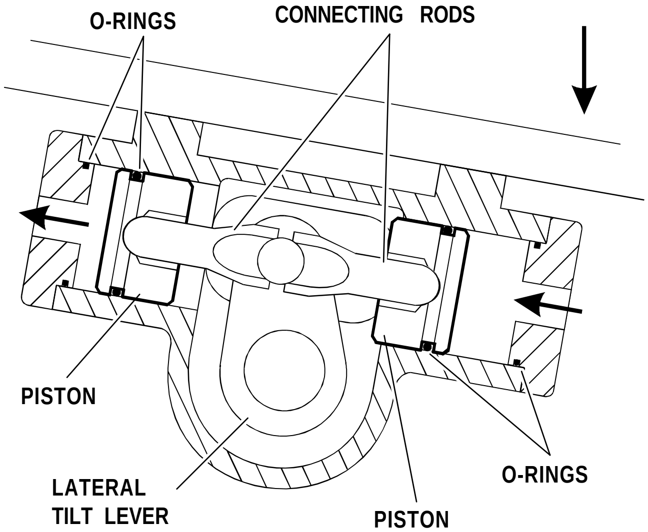


Figure 1-12. Lateral Tilt Cylinder Assembly

5. Elevation Cylinder - This single action cylinder does not have hydraulic fluid on both sides of the piston. It depends on the weight of the table top assembly to lower it.
The cylinder is set in the center of the elevation main column. The two stage cylinder is elevated by the driven force of the oil pressure. When lowering, the oil that is accumulated in the cylinder is returned to the oil reservoir through the mini-valve due to the table top weight.
A slider support assembly is used to support the weight of the upper table section. A stainless steel shroud covers the flexible hydraulic hoses and slider. See figure 1-13.

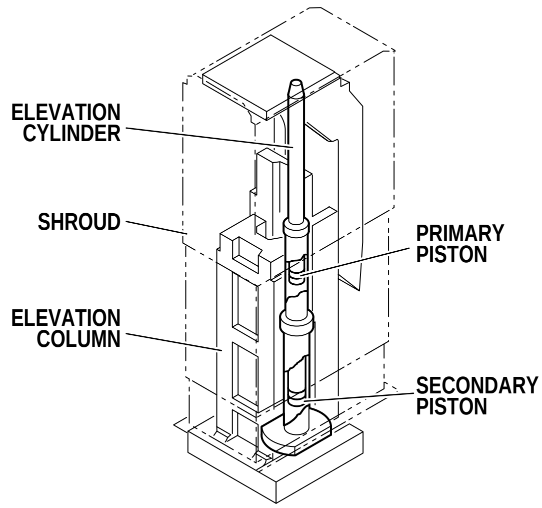


Figure 1-13. Elevation Cylinder Assembly

6. Brake Cylinders - The brake cylinders are single action type similar to the elevation cylinder. The movable piston's ram is connected to a brake pad. See figure 1-14. Oil pumped into the top of the cylinder pushes the piston down raising the table base off its casters. An internal return spring on the bottom of the piston, pushes the piston up to return the oil through the mini-valve to the reservoir.

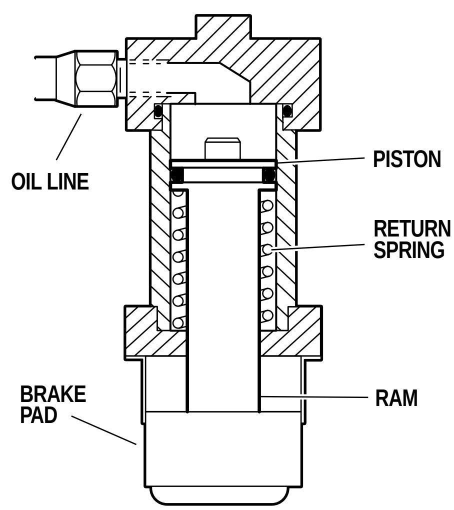


Figure 1-14. Brake Cylinder

h. Elevation Cylinder Return Circuit

A three-way (single check valve type) mini-valve controls both the elevation and return circuits. The elevation circuit operation within the mini-valve is identical to the operation of the four-way valves previously described (inlet pressure opens the check valve allowing the oil to enter the cylinder). In the return position, inlet pressure pushes the pilot plunger up and opens the return check valve. See figure 1-15. The open check valve allows a path for the oil in the elevation cylinder to return to the reservoir. When the pilot plunger valve is opened, the continuing pump pressure opens the pressure relief valve which provides a return oil path to the reservoir.

The mini-valve used in the elevation circuit contains only one check valve (all four-way mini-valves use two check valves). The check valve is used to trap the oil in the elevation cylinder thereby supporting the table top. When the top is being lowered the check valve is mechanically held open by the pilot plunger through pump pressure.

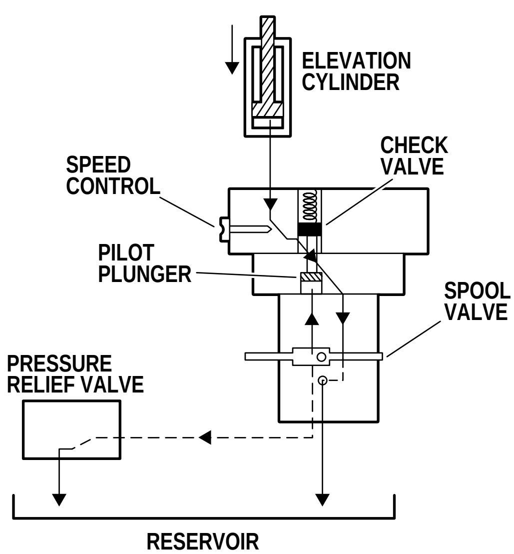


Figure 1-15. Elevation Return Circuit

i. Brake System

The brake system consists of the following components: (figure 1-16)

1. Single action slave cylinders (4 each).
2. 3-way (single check valve type) mini-valve.
3. Manually controlled emergency brake release.
4. Plumbing terminal, flexible hoses, copper lines and "O" rings.
5. Portions of the electrical system.

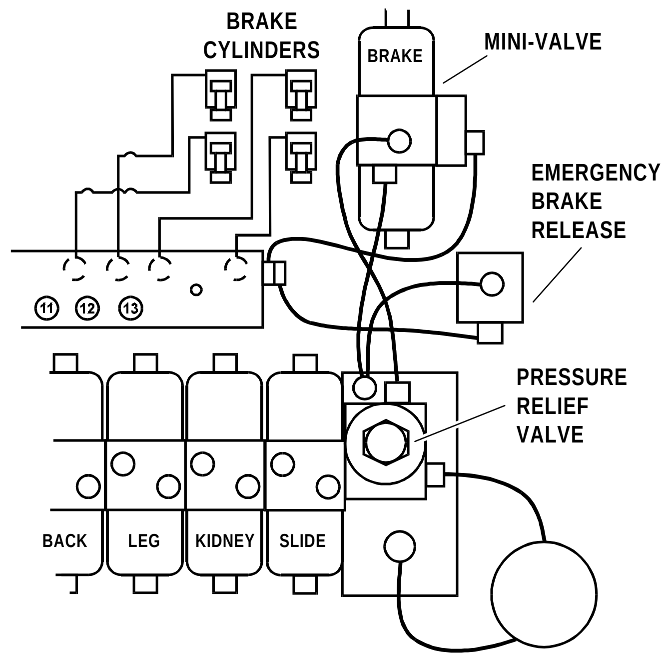


Figure 1-16. Brake System Block Diagram

Each corner of the cast-iron table base has a hydraulic brake cylinder. These single action cylinders are hydraulically connected in parallel to the mini-valve and all four are activated together. It is normal for one corner of the table to raise before the others due to the weight distribution of the table.

An electronic timer in the relay box is activated when any function on the pendant control is pushed momentarily. The pump/motor and brake system mini-valve is activated and the brake cylinders are completely set. The electronic timer runs for approx. 8-10 seconds.

The brakes are released by pushing the BRAKE UNLOCK button momentarily. An electronic timer in the relay box activates the brake function hydraulic mini-valve and pump/motor.

When activated, the return hydraulic circuit operates similar to the elevation cylinder return circuit. Return springs inside the single action brake cylinders retract the brake pads and provide the pressure to return the hydraulic oil back to the reservoir. The electronic timer operates the return circuit for approximately 8-10 seconds.

j. Emergency Brake Release

The emergency brake release is simply a manually operated bypass valve connected in parallel to the brake cylinders and the oil reservoir. See figure 1-17. When the valve is opened (turned counter-clockwise) a return circuit for the brake hydraulic fluid is opened. The return springs force the pistons up pushing the hydraulic oil back into the reservoir and retracting the brake pads.

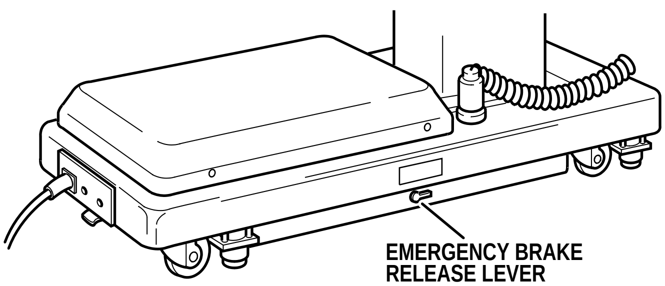


Figure 1-17.

IMPORTANT

•The emergency brake release valve must be tightened securely when not in use.

•If the emergency brake release valve has been operated, the UNLOCK button on the pendant control may have to be pressed before brakes will lock again.

If the emergency brake release valve is open or loose, two conditions could occur:

1. The brakes will release slowly- depending on how loose the valve is, this could take anywhere from a few minutes to several hours.

2. None of the table functions will operate properly if the valve is wide open. All of the hydraulic fluid from the pump is simply pumped through the brake bypass circuit because that is the easiest path for the oil to follow.

k. Flex/Reflex System

The Flex/Reflex system has a mini-valve which connects the trendelenburg and back section hydraulic systems in a series. When FLEX is activated by the pendant control, the Flex/Reflex mini-valve opens the oil pressure path to the Reverse Trendelenburg piston. The return oil path from the trendelenburg piston is routed through the back section cylinder to the mini-valve return port. See figure 1-18.

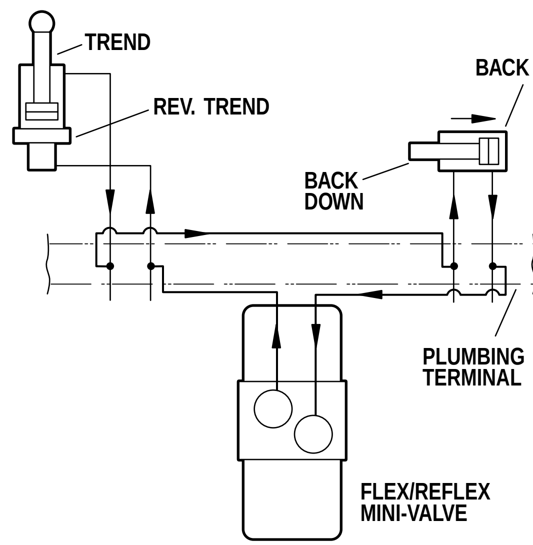


Figure 1-18. Flex/Reflex System

1-3. Hydraulic Adjustments

a. Fluid Level.

The fluid level should be approximately 1/2" below the filler hole or gasket surface. If additional fluid is needed, remove the filler vent cap with a phillips screwdriver and add fluid through this opening using a funnel. See figure 1-19.

NOTE

> The elevation cylinder should be completely down and all the other control functions in their neutral position when checking oil level.

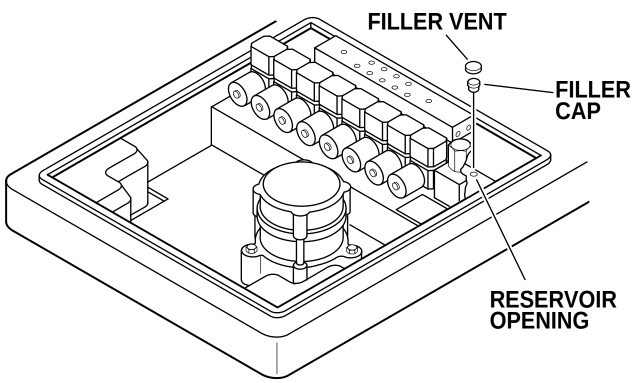


Figure 1-19.

The type of oil that should be used is Mobil DTE #25 or equivalent. This is a very high quality hydraulic oil. The table requires approximately two quarts of oil to operate properly.

b. Bleeding The Hydraulic System

To purge the air from the hydraulic system, operate each function back and forth at least two or three times.

NOTE

> Whenever a hydraulic line or component is replaced, bleed the air out of the lines using the pump pressure before making the final connection. Then operate the function until it stalls in both directions.

c. Pressure Relief Valve

The pressure relief valve is adjusted by turning the adjustment nut until the desired pressure is reached.

To adjust:

1. Remove the plumbing bolt securing the brake system line to the pressure relief valve and attach a hydraulic pressure gauge as shown in figure 1-20 using a long 6mm plumbing bolt.

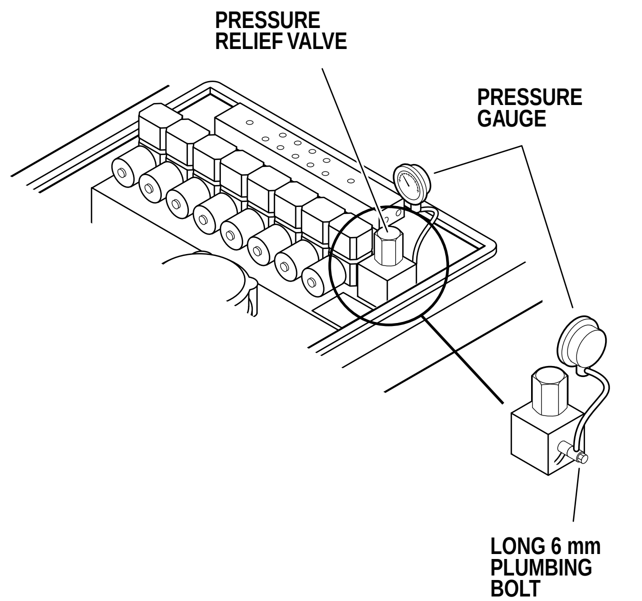


Figure 1-20.

2. Raise the table top until the piston reaches the end of its stroke and stalls. Observe reading on pressure gauge and turn the adjustment nut (clockwise to increase oil pressure, counter-clockwise to decrease) until desired reading is obtained. Pressure should be 80KG/CM^2 -1138 PSI.

d. Speed Controls

The speed controls restrict the volume of oil returning back to the reservoir thereby controlling the speed of each control function.

All four-way mini-valves, have two speed controls located in the ends of each valve body. All three-way mini-valves have only one speed control.

One speed control adjusts one direction of a particular function and the opposite speed control adjusts the other direction. They are adjustable by using a small straight blade screwdriver and turning the adjustment screw clockwise to decrease the speed and counterclockwise to increase the speed. Refer to figure 1-21.

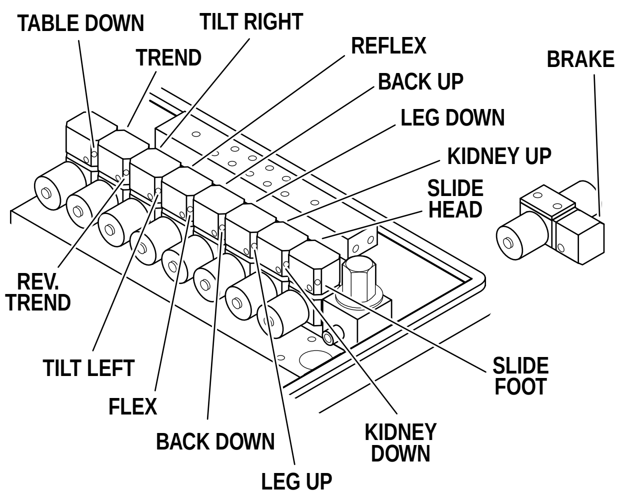


Figure 1-21.

Any control function should move in either direction at the same rate. If the rate of a certain function is too slow, open the speed control slightly and recheck. Use the second hand on a watch and time a particular function. Match that time in the opposite direction by opening or closing the speed control. Approximate operating times are as follows:

Elevation Down	30 seconds
Lateral Tilt	7 seconds
Leg-Up	25 seconds
Leg-Down	15 seconds
Kidney Lift	7 seconds
Slide	20 seconds

A pressure gauge should be used to set the speed of the back section, trendelenburg and flex control functions.

To adjust:

1. Attach the pressure gauge onto the main oil galley as shown in figure 1-20.

2. The gauge should read the following values when operating the various control functions in either direction. Turn the speed controls until desired values are obtained.

Back Section	Up	65KG/CM^2-925PSI
	Dn	65KG/CM^2-925PSI
Trendelenburg	Up	65KG/CM^2-925PSI
	Dn	65KG/CM^2-925PSI
Flex		70KG/CM^2-995PSI
Reflex		70KG/CM^2-995PSI

NOTE

When adjusting Flex/Reflex speed controls, set Reflex last.

Elevation - There is not a speed adjustment for raising the table. The speed control will only affect the rate of descent and it should equal the rate of elevation.

2-1. Back Section Gear Mesh Adjustment

The gear mesh is adjusted by the use of an eccentric cam. This cam moves the gear teeth closer together to eliminate gear lash. This adjustment arrangement compensates for any wear between the gears that might occur.

To adjust:
Loosen the cam locking allen set screw. Use an allen wrench to rotate the eccentric cam. See figure 2-1. Tighten the set screw when adjustment is complete.

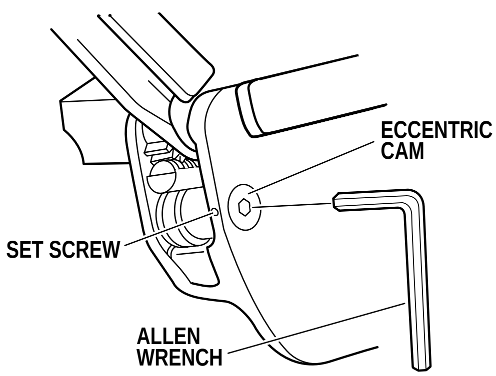


Figure 2-1. Eccentric Cam Adjustment

2-2. Hydraulic Cylinder Adjustment

Back & Leg Sections

The hydraulic cylinder rams that control both the back and leg sections must move together so that these sections are not twisted when operated. This is accomplished by the use of eccentric cams that move the cylinder bodies fore and aft to adjust their effective stroke.

NOTE

Adjust gear mesh before adjusting eccentric cams for the back section.

a. Back Section

Position the back section all the way up until it stalls. Both sides of the back section should stop moving at the same time and should not show any signs of twisting.

Any twisting or flexing of the back section as it approaches the stalled position indicates that one of the cylinders is not reaching its fully extended position at the same time as the other. This condition would require an adjustment.

To adjust:
Remove the top from the seat section for access to the locking set screws.

Loosen the set screw located above the eccentric cam in each side frame. Use an allen wrench to turn the cylinder eccentric cams as required to shift either cylinder fore or aft as needed so no twisting or flexing of the back section is observed when it is stalled in the full up position. Tighten the set screws and replace the seat section top when proper adjustment has been achieved. See figure 2-2.

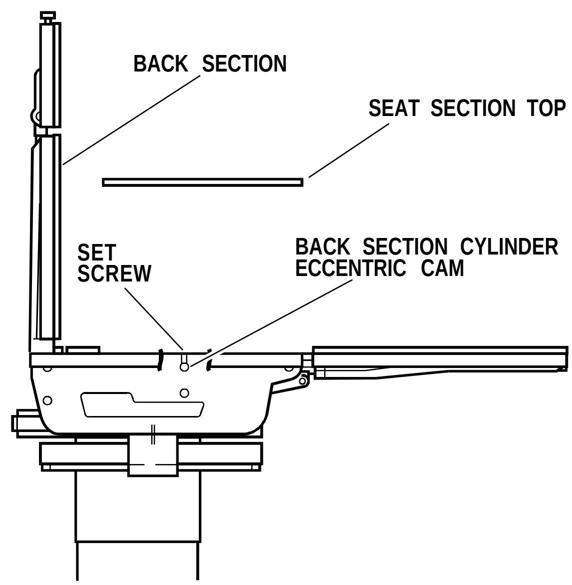


Figure 2-2. Back Section Adjustment

b. Leg Section

Position the leg section all the way up until it is horizontal. Both sides of the leg section should stop moving at the same time and should not show any signs of twisting.

Any twisting or flexing of the leg section as it approaches the stalled position indicates that one of the cylinders is not reaching its fully extended position at the same time as the other and an adjustment is required.

To adjust:

Loosen the cam locking set screws located on the bottom of the cylinder mounting plates inside the table side frames. Use an allen wrench to turn the cylinder eccentric cams as required to shift either cylinder fore or aft as needed so no twisting or flexing of the leg section is observed when it is stalled in the horizontal position. Tighten set screws when proper adjustment is achieved. See figure 2-3.

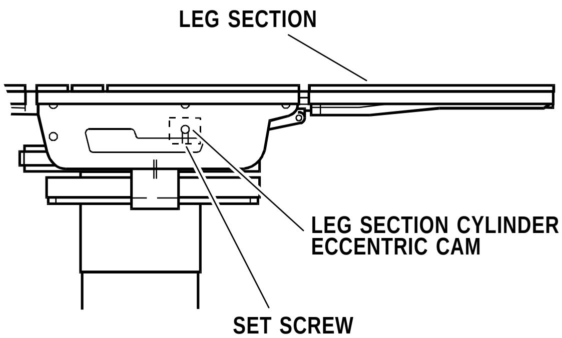


Figure 2-3. Leg Section Adjustment

c. Slide and Kidney Lift Cylinders
If the Slide or Kidney Lift cylinder has been removed, the distance from the end of the piston to the end of the cylinder housing must be checked to make sure the functions will operate correctly.

With table top centered, the distance from the end of the Slide piston to end of cylinder is:

Head End - 82 mm **Foot End - 120 mm**

The table top should slide 7-1/2" toward the head and 13-1/4" toward the foot when positioned properly. Refer to figure 2-4.

With Kidney Lift all the way down, the distance from the end of the Kidney Lift piston to end of cylinder is:

Head End - 82 mm **Tail End - 11 mm**

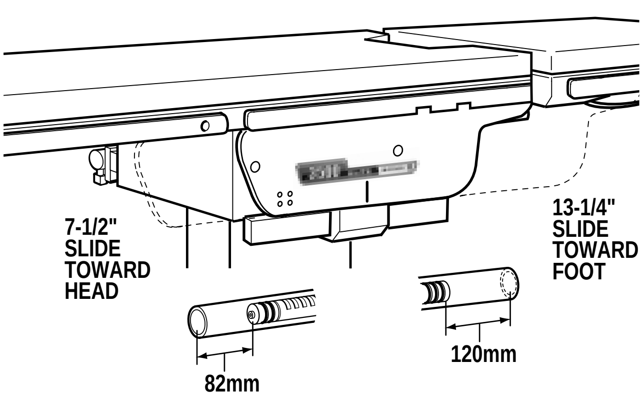


Figure 2-4.

2-3. Slide Roller Adjustment

The pivot pins on the slide rollers are eccentric cams. The rollers can be adjusted if required to maintain proper top slide operation.

To adjust:
Remove the Seat section top, the hose cover and the right and left lateral tilt frame covers for access to the top rollers.

1. Align the table top so the rollers to be adjusted are contacting the slide bars.

2. Loosen the adjustment cam set screw and adjust the roller using an 8mm Allen wrench. See figure 2-5. To avoid any possible binding in the slide mechanism, adjust the roller on the opposite side of the table in the same manner (cam turned toward same end of table on each side).

3. Adjust rollers so top slides smoothly with no up or down movement of the table top.

4. When adjustment is complete, tighten set screws, replace covers and top section.

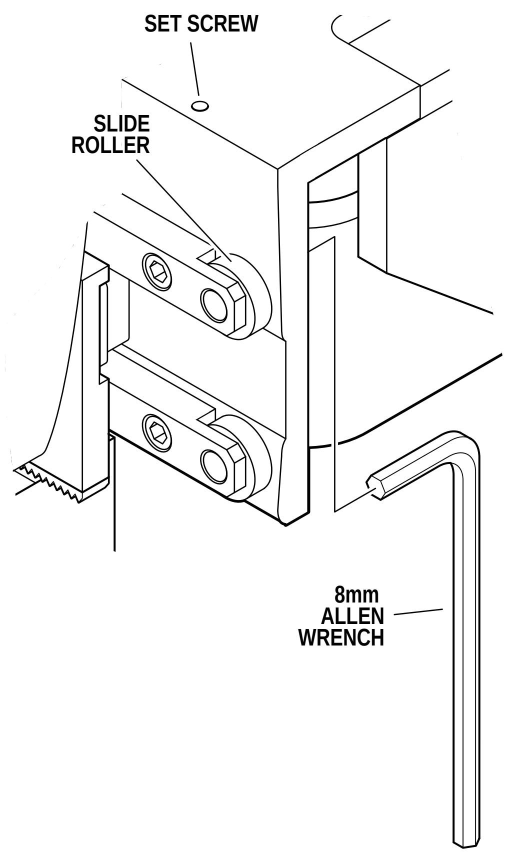


Figure 2-5.

3-1. Precautions

Before attempting to troubleshoot any hydraulic problem on the table, please read through the precautions and notes below.

CAUTION

When disconnecting any of the hydraulic lines, fittings, joints, hoses, etc., for the following control functions, be sure these table surfaces are in their down position or completely supported.

Elevation
Back Section
Leg Section
Kidney Lift

When working on the trendelenburg or lateral tilt hydraulic circuits, be sure to support the table top. When working on the brake system make sure the brakes are completely retracted.

CAUTION

Failure to follow these precautions may result in an uncontrolled oil spray and damage to the table or personal injury.

3-2. Troubleshooting Notes

When troubleshooting a table malfunction, first determine the following:

1. Does the problem affect all control functions?
2. Does the problem affect only one control function?
3. If the problem affects one control function is it in both directions?
4. Is the problem intermittent?
5. Is the problem no movement of a table surface or does the table surface lose position?

Once the problem has been determined, concentrate on that particular hydraulic circuit or control function.

Listed below are the hydraulic components that are common with all hydraulic circuits. If there is a problem with any of them, it could affect all control functions.

1. Motor/Pump Assembly
2. Reservoir
3. Pressure Relief Valve
4. Certain Oil Lines and Galleys

If there was a problem in the following components, only one control function would normally be affected.

1. Mini-Valve
2. Slave Cylinder
3. Oil Lines

NOTE

Whenever a hydraulic line or component is replaced, bleed the air out of the lines using the pump pressure before making the final connection. After all connections are tight, cycle the control function back and forth two or three times to purge the remaining air from the system.

IMPORTANT

When installing new "O" rings use hydraulic oil to thoroughly lubricate the "O" rings and cylinder. Keep everything clean.

Each complete oil circuit is shown on the following pages. When troubleshooting a particular function, refer to the appropriate oil circuit diagram and the list of possible problems.

3-3. ELEVATION DIAGNOSIS CHART

Problem	Reason
Table will not elevate properly	Pressure Relief Valve Not Set Properly Low on Oil Spool Valve Not Centered or Adjusted Properly Defective Pump Defective Mini-Valve Defective Solenoid or Wiring Defective Relay Box or Pendant Control
Table will not descend properly	Incorrect Speed Adjustment Bad Check Valve Spool Valve Not Centered Defective Solenoid or Pendant Control
Table loses elevation	Bad Check Valve Leaking Mini-Valve Loose Fittings, Joints, Hoses Leaking "O" Ring Inside Cylinder

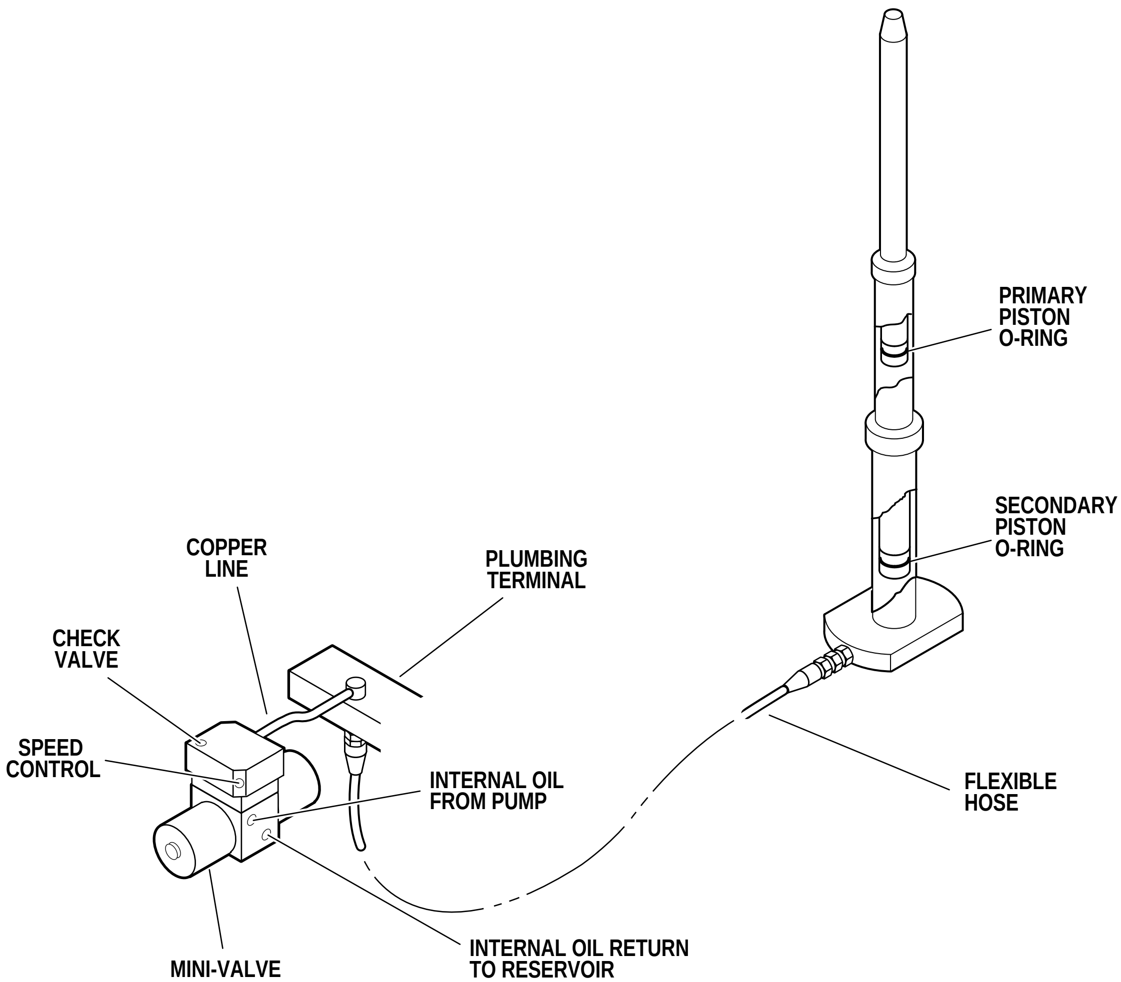


Figure 3-1. Elevation Circuit

3-4. TRENDELENBURG DIAGNOSIS CHART

Problem	Reason
Trendelenburg function moves improperly	Incorrect Speed Adjustment Spool Valve Not Centered or Adjusted Properly Bad Check Valves Low on Oil Pinched Hose Defective Mini-Valve Pressure Relief Valve Not Set Properly Defective Solenoid or Wiring Defective Relay Box or Pendant Control
Trendelenburg function chatters or loses position	Defective or Dirty Check Valve Oil Leakage in Circuit Air Inside Cylinder Pinched Hose Low on Oil

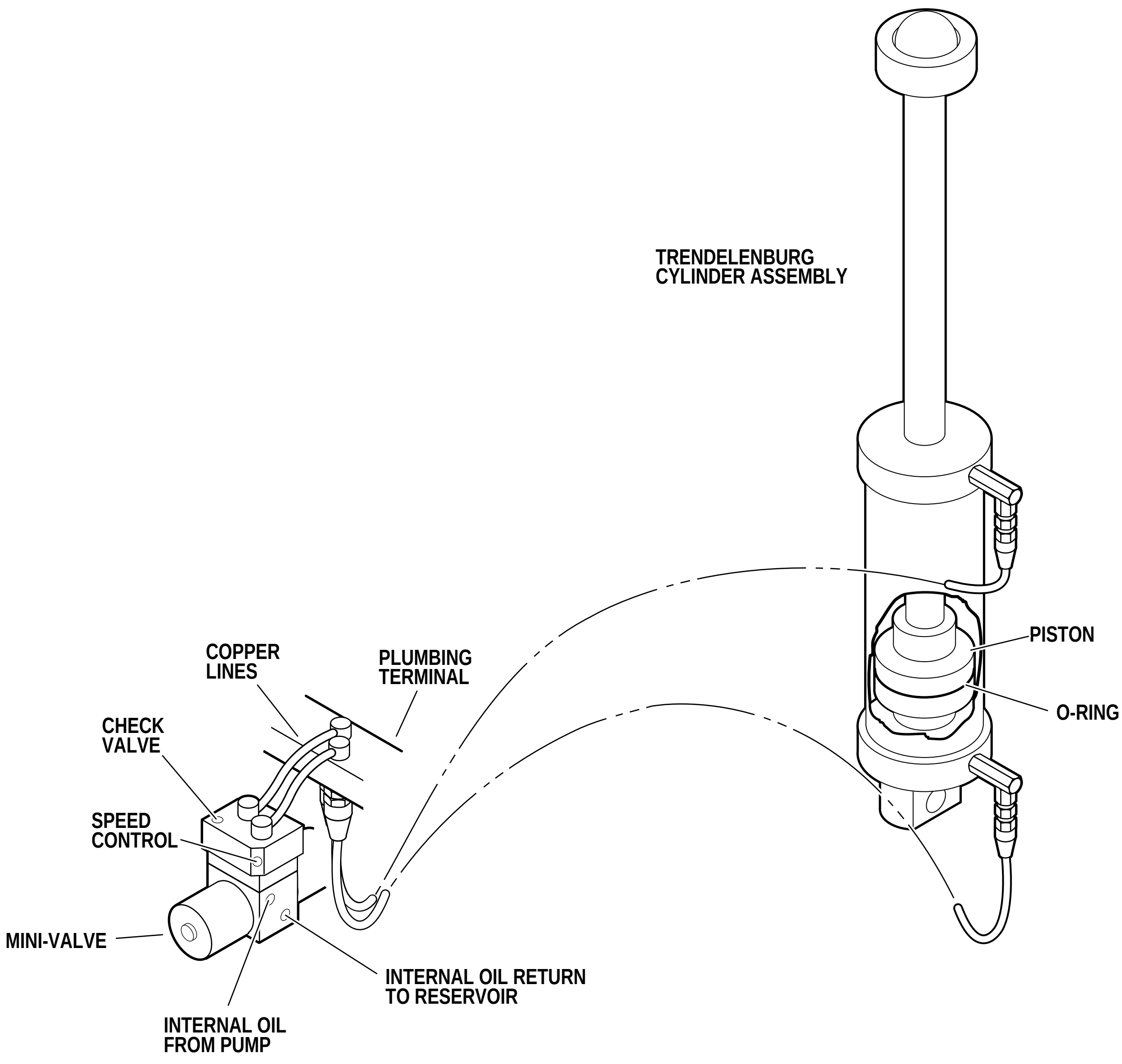


Figure 3-2. Trendelenburg Circuit

3-5. LATERAL TILT DIAGNOSIS CHART

Problem	Reason
Lateral tilt function moves improperly	Incorrect Speed Adjustment Spool Valve Not Centered or Adjusted Properly Bad Check Valves Low on Oil Pinched Hose Defective Mini-Valve Pressure Relief Valve Not Set Properly Defective Solenoid Defective Relay Box or Pendant Control
Lateral tilt function chatters or loses position	Defective or Dirty Check Valves Oil Leakage in Circuit Air Inside Cylinder Pinched Hose Low on Oil

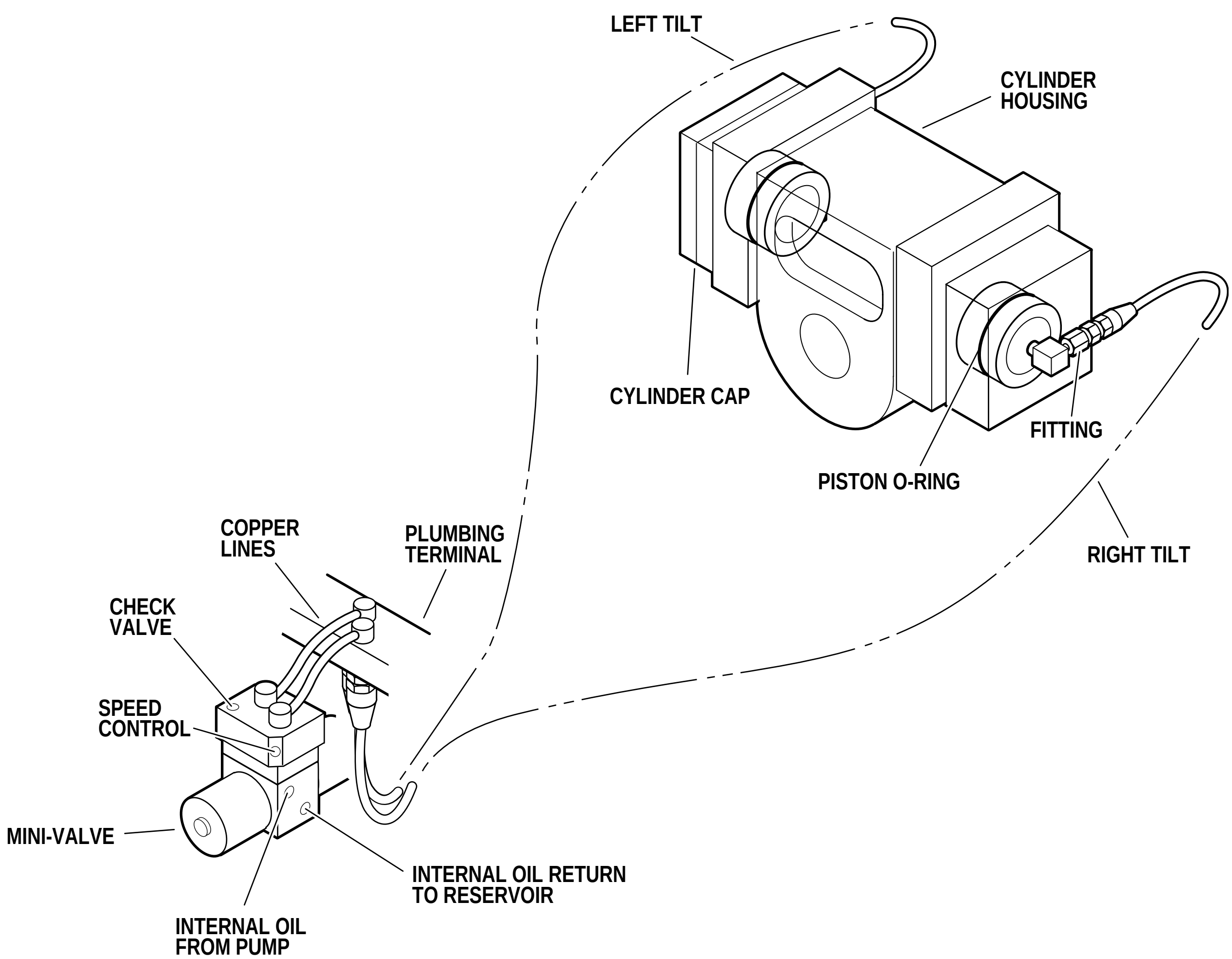


Figure 3-3. Lateral Tilt Circuit

3-6. BACK SECTION DIAGNOSIS CHART

Problem	Reason
Back Section function moves improperly	Incorrect Speed Adjustment Spool Valve Not Centered or Adjusted Properly Bad Check Valves Low on Oil Pinched Hose Defective Mini-Valve Pressure Relief Valve Not Set Properly Defective Solenoid or Wiring Defective Relay Box or Pendant Control
Back Section function chatters or loses position	Defective or Dirty Check Valves Oil Leakage in Circuit Air Inside Cylinder Pinched Hose Low on Oil

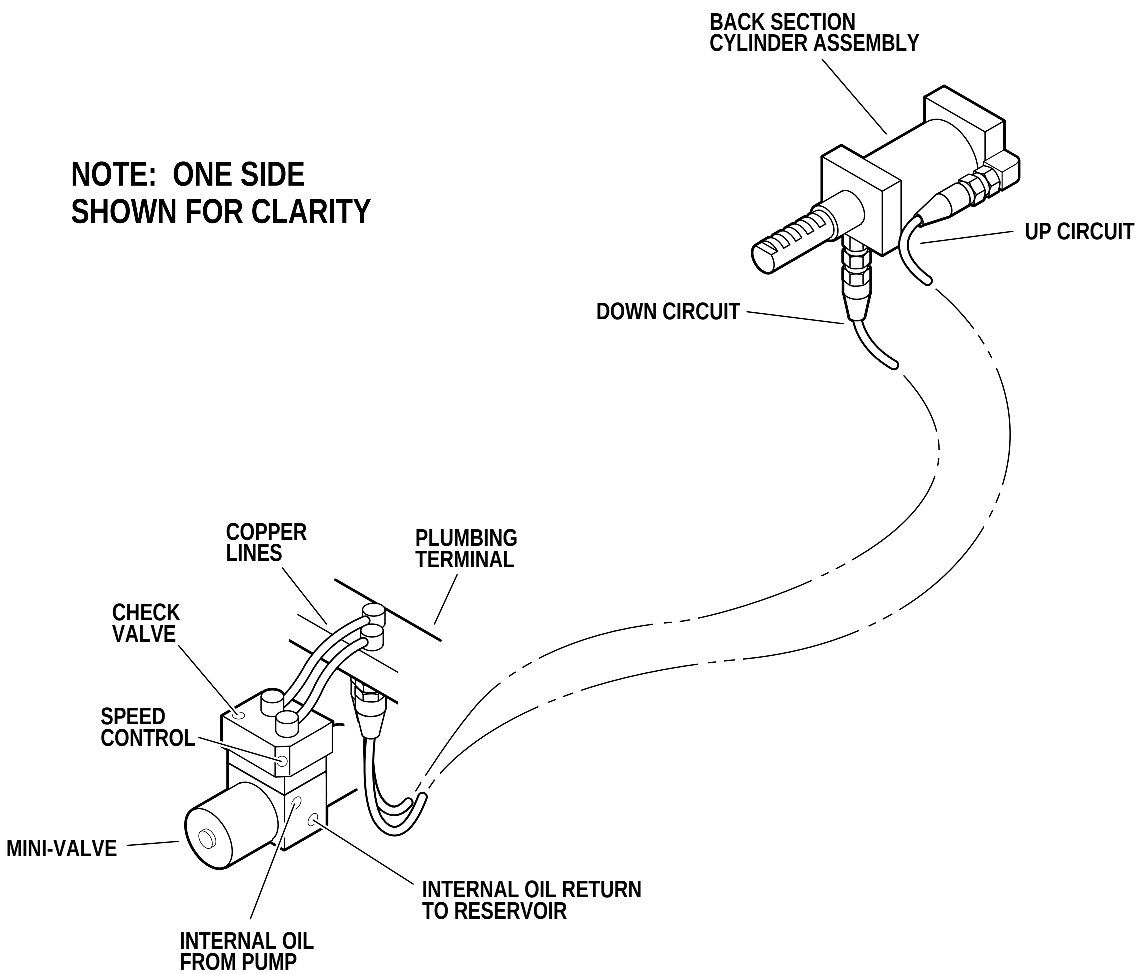


Figure 3-4. Back Section Circuit

3-7. FLEX SYSTEM DIAGNOSIS CHART

Problem	Reason
Back Section or Trendelenburg function moves improperly	Incorrect Speed Adjustment (Trendelenburg, Back Section or Flex - check with gauge) Spool Valve Not Centered or Adjusted Properly Bad Check Valves Low on Oil Pinched Hose Defective Mini-Valve Pressure Relief Valve Not Set Properly Defective Solenoid or Wiring Defective Relay Box or Pendant Control
Back Section or Trendelenburg function chatters or loses position	Defective or Dirty Check Valves Oil Leakage in Circuit Air Inside Cylinder Pinched Hose Low on Oil

IMPORTANT

If Flex System does not function properly, check the back section and trendelenburg functions before adjusting the flex system.

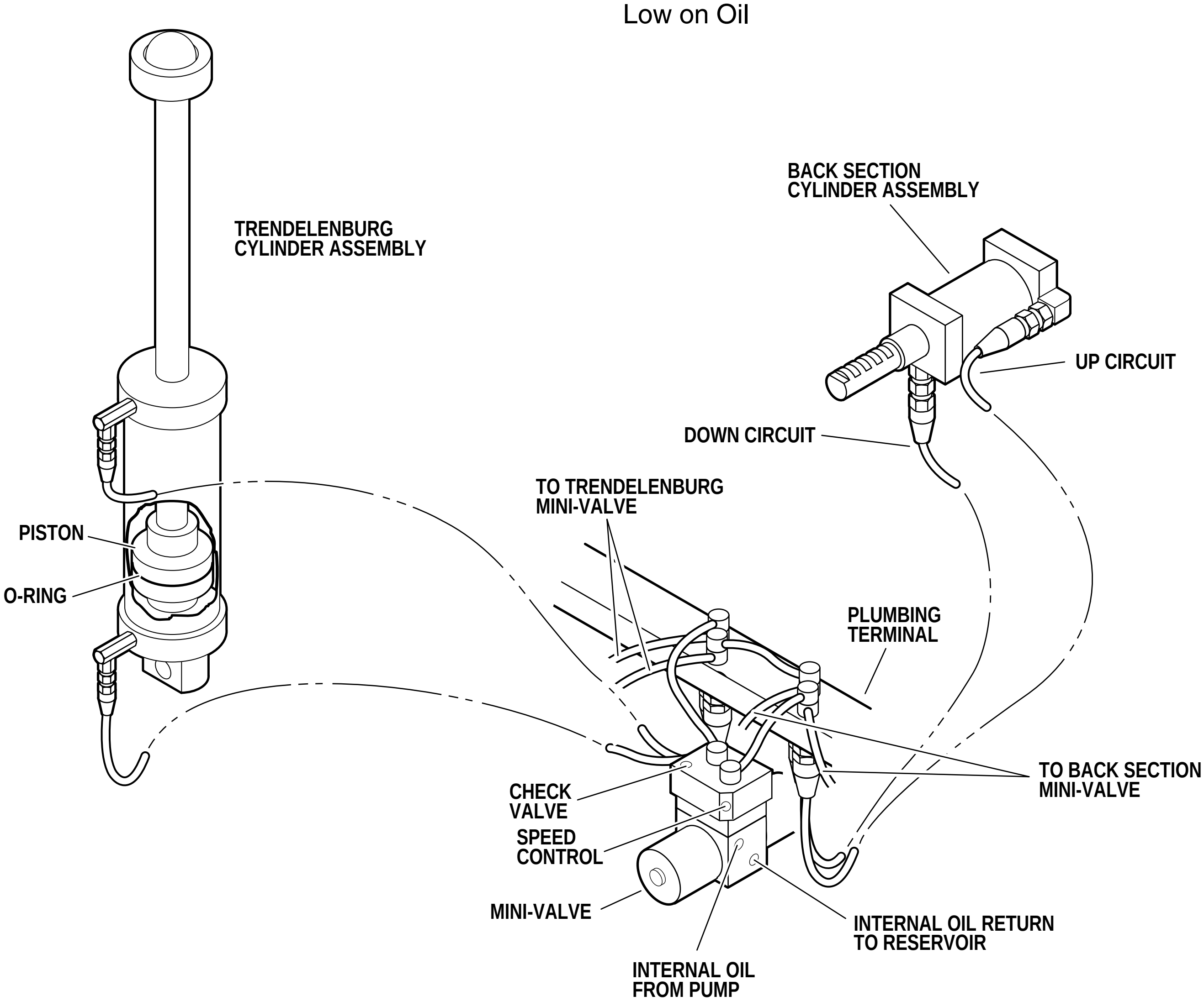


Figure 3-5. Flex System Circuit

3-8. LEG SECTION DIAGNOSIS CHART

Problem	Reason
Leg function moves improperly	Incorrect Speed Adjustment Spool Valve Not Centered or Adjusted Properly Bad Check Valves Low on Oil Pinched Hose Defective Mini-Valve Pressure Relief Valve Not Set Properly Defective Solenoid or Wiring Defective Relay Box or Pendant Control
Leg function chatters or loses position	Defective or Dirty Check Valves Oil Leakage in Circuit Air Inside Cylinder Pinched Hose Low on Oil

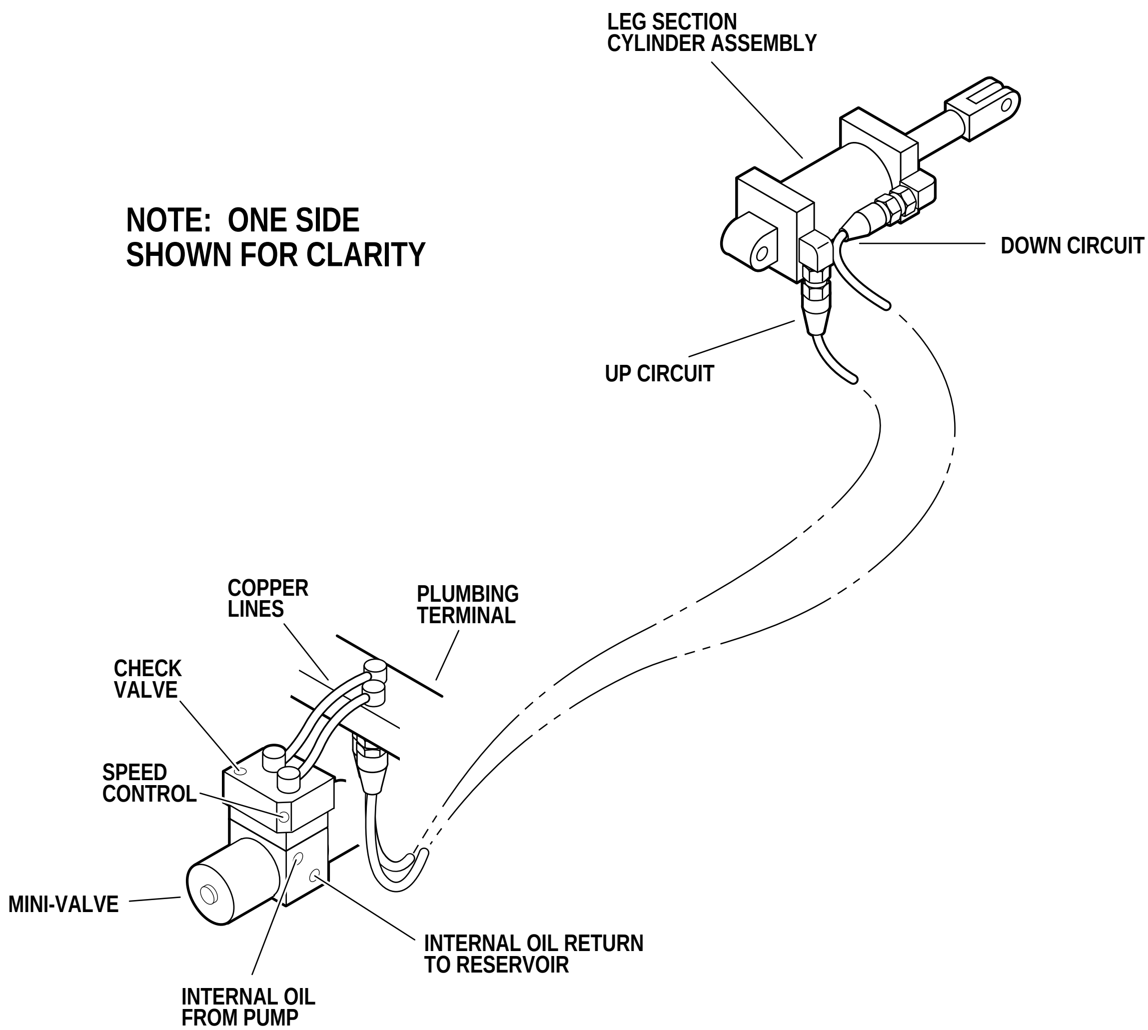


Figure 3-6. Leg Section Circuit

3-9. KIDNEY LIFT DIAGNOSIS CHART

Problem	Reason
Kidney Lift moves improperly	Incorrect Speed Adjustment
	Spool Valve Not Centered or Adjusted Properly
	Bad Check Valve
	Low on Oil
	Pinched Hose
	Defective Mini-Valve
	Pressure Relief Valve Not Set Properly
	Defective Solenoid or Wiring
	Defective Relay Box or Pendant Control
Kidney Lift chatters or loses position	Defective or Dirty Check Valve
	Oil Leakage in Circuit
	Air Inside Cylinder
	Pinched Hose
	Low on Oil
	Lift Rods Binding

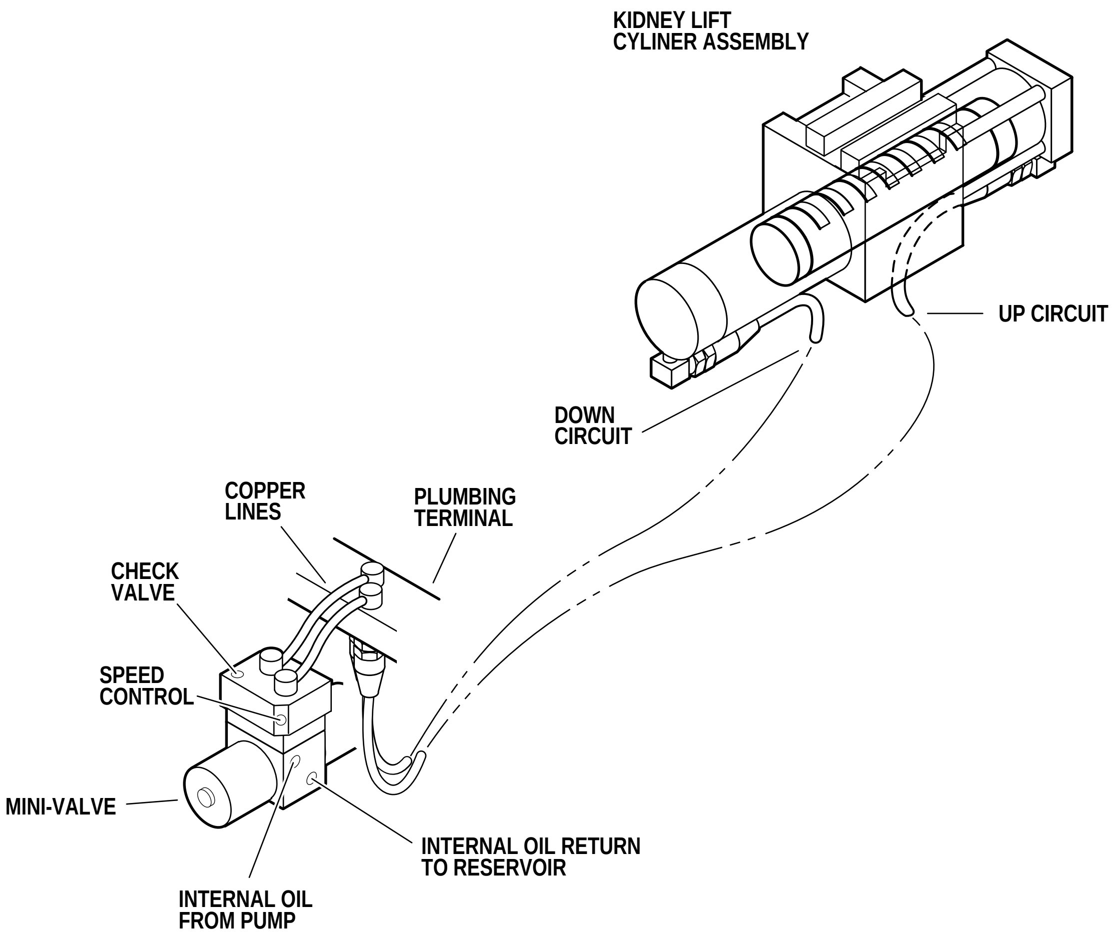


Figure 3-7. Kidney Lift Circuit

3-10. SLIDE DIAGNOSIS CHART

Problem	Reason
Slide function moves improperly	Incorrect Speed Adjustment Spool Valve Not Centered or Adjusted Properly Bad Check Valves Low on Oil Pinched Hose Defective Mini-Valve Pressure Relief Valve Not Set Properly Defective Solenoid or Wiring Defective Relay Box or Pendant Control
Slide function chatters or loses position	Defective or Dirty Check Valve Oil Leakage in Circuit Air Inside Cylinder Pinched Hose Low on Oil

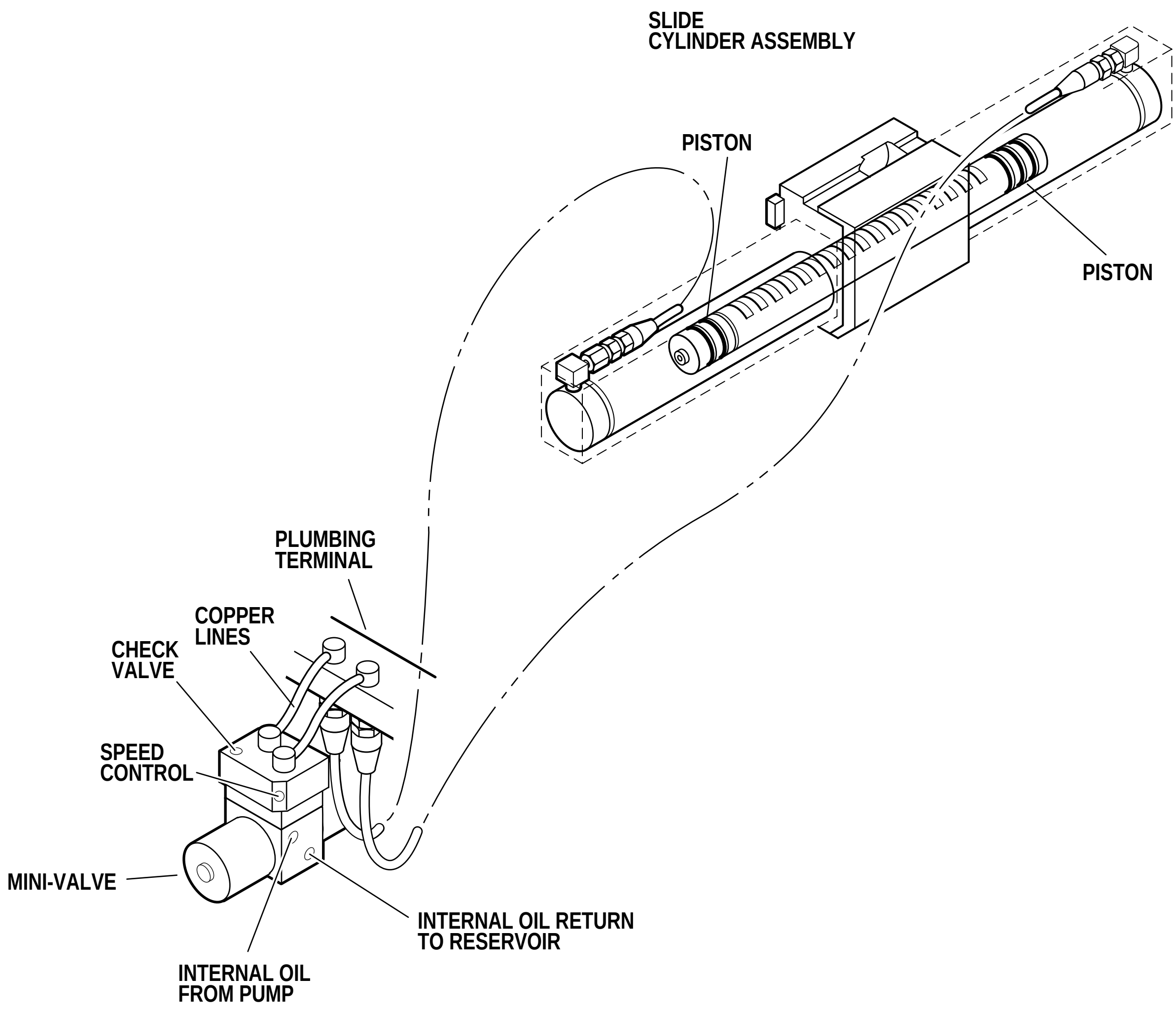


Figure 3-8. Slide Circuit

3-11. BRAKE CIRCUIT DIAGNOSIS CHART

Problem	Reason
Brakes will not set properly	Emergency Brake Release Valve Open or Defective
	Spool Valve Not Centered or Adjusted Properly
	Bad Check Valve
	Low on Oil
	Pressure Relief Valve Not Set Properly
	Pinched Hose
	Defective Mini-Valve
	Defective Relay Box or Pendant Control
Brakes will not stay locked	Emergency Brake Release Valve Open or Defective
	Defective or Dirty Check Valve
	Oil Leakage in Circuit
	Leaking "O" Ring Inside Cylinder
Brakes will not retract properly	Incorrect Speed Adjustment
	Bad Check Valve
	Spool Valve Not Centered
	Defective Mini-Valve
	Pinched Hose
	Defective Solenoid or Wiring
	Defective Relay Box or Pendant Control

NOTE

If brakes have been released with the Emergency Brake Release Valve, brakes will not reset until BRAKE UNLOCK Circuit has been activated.

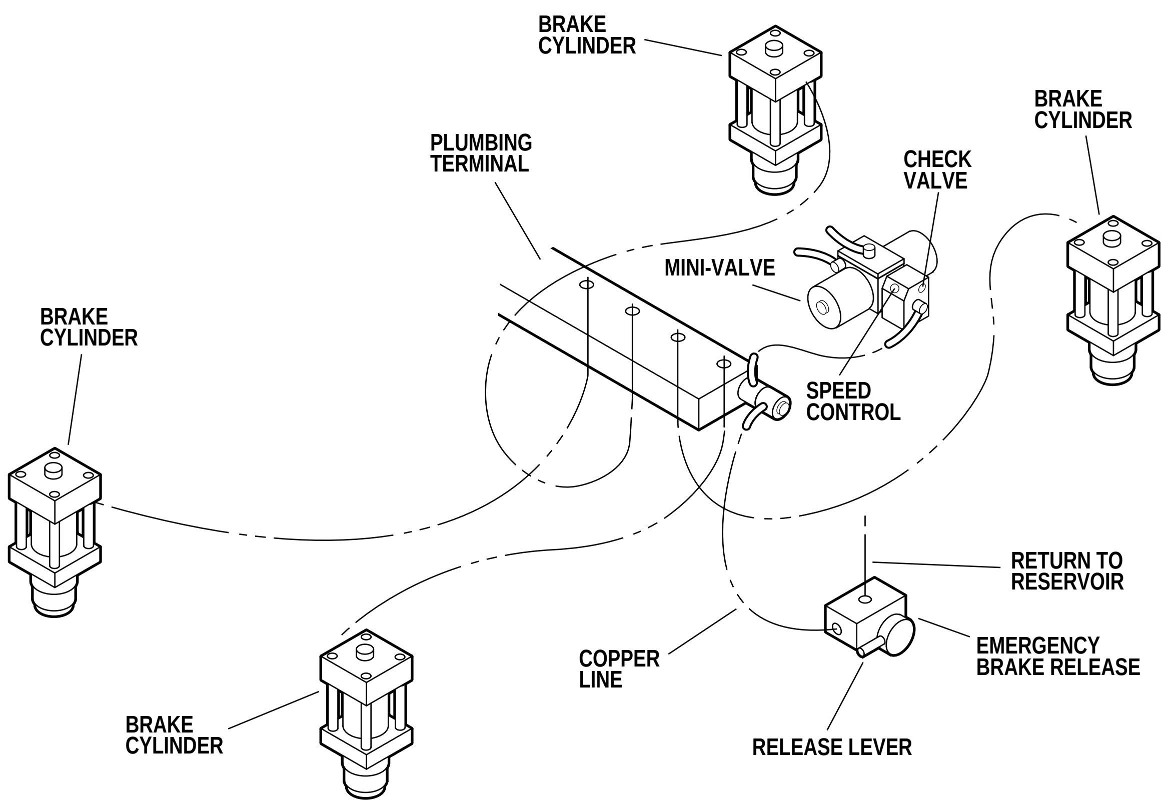


Figure 3-9. Brake System Circuit

3-12. Flexible Hose Identification and Placement

The flexible hydraulic hoses used in the table are number coded to aid in the correct placement of the hoses from the plumbing terminal to their respective hydraulic cylinders. Figure 3-10 shows the correct placement of the flexible hydraulic hoses and their respective number codes.

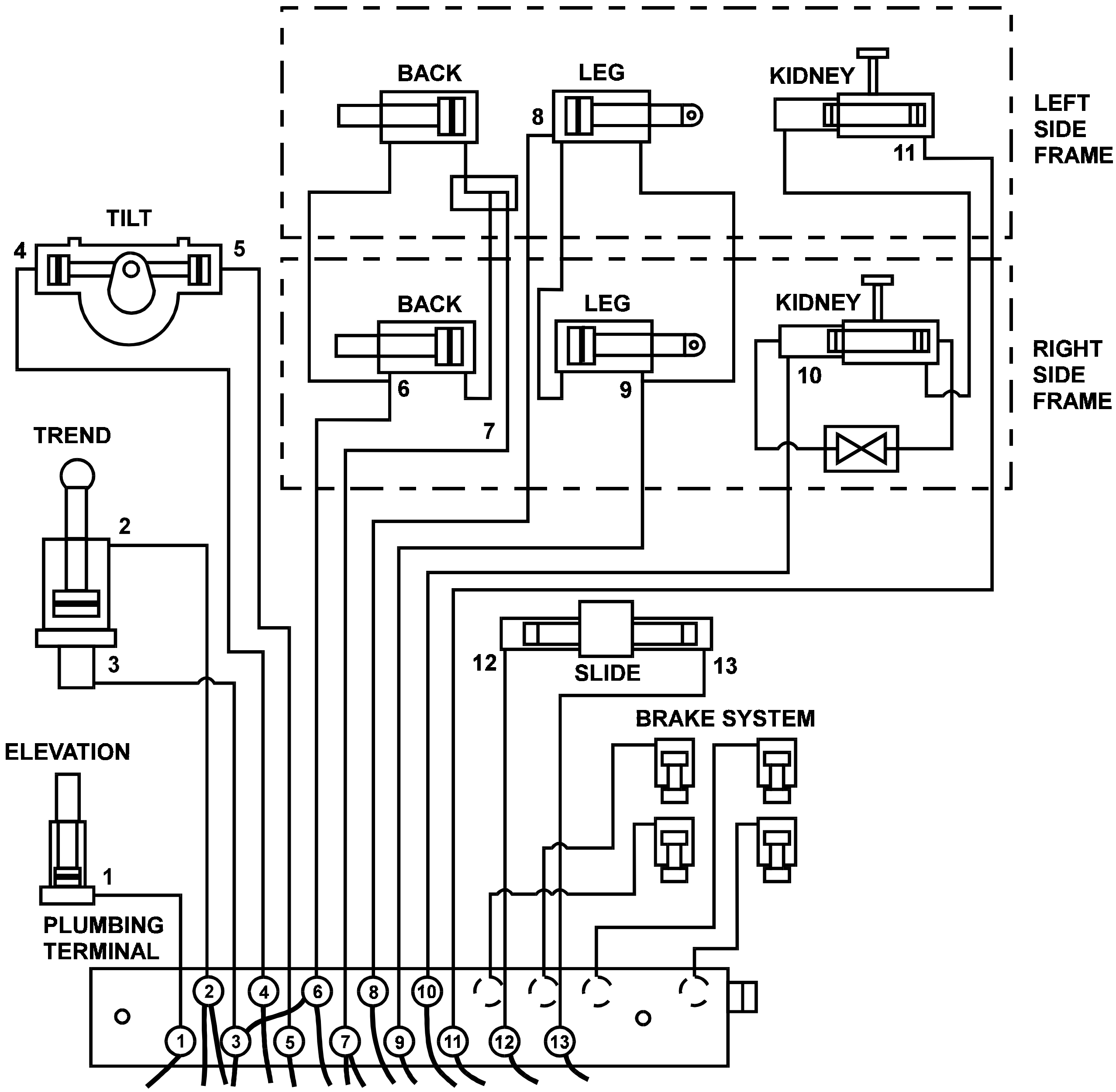


Figure 3-10. Flexible Hoses

3-13. Kidney Lift System

The Kidney Lift cylinders are connected in series so that both cylinders operate simultaneously.

Hydraulic pressure on one side of the lead piston causes the piston to move. The piston movement forces the hydraulic fluid on the other side of the piston through the system to the other cylinder. This simultaneously activates the other piston. A bypass system is connected to the right cylinder assembly for initial set-up and adjustment of the kidney lift system. Use the following procedures to bleed or adjust the system if needed.

a. Bleeding the System - If the hydraulic lines or cylinders have been disconnected from the kidney lift system for any reason, use the following procedure to bleed the air from the system.

1. Remove the kidney lift top section and begin the procedure with both pistons in the down position (chambers A & C) as shown in figure 3-11.

2. Make sure the bypass valve is closed (valve screw tight) and activate "KIDNEY DOWN". The hydraulic fluid will fill cavity "D" as shown in figure 3-11.

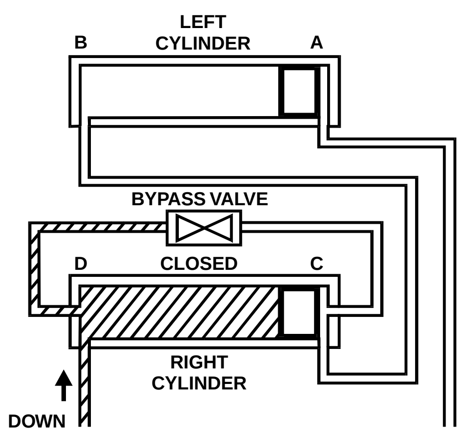


Figure 3-11.

3. Open the bypass valve by loosening the screw in the bottom of the valve and activate "KIDNEY UP". Hydraulic fluid fills cavity "A" and pushes the piston into cavity "B". The open valve allows a path for air to escape from cavity "B" without affecting the piston in "C". See figure 3-12.

4. Leave the bypass valve open and activate "KIDNEY DOWN". Hydraulic pressure keeps the piston in chamber "C", the hydraulic fluid passes through the bypass valve and fills cavity "B" pushing the piston into cavity "A". See figure 3-13.

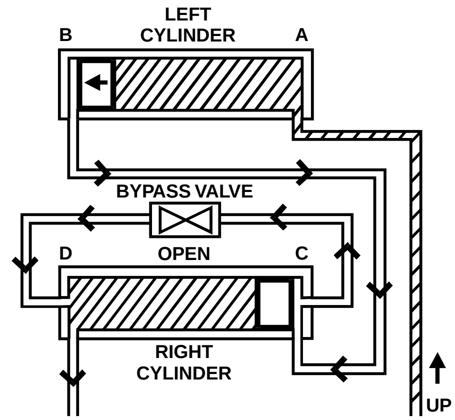


Figure 3-12.

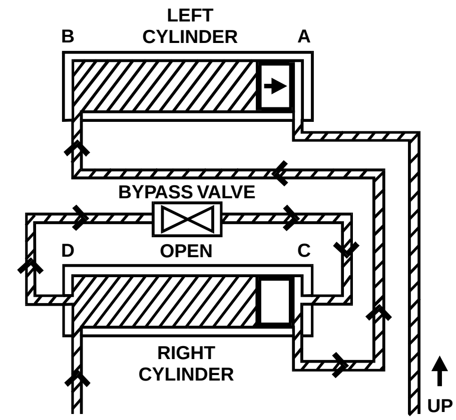


Figure 3-13.

5. Repeat steps 3 and 4 as needed to remove any remaining air in the system.

6. With both pistons in the full down position, activate "KIDNEY DOWN" to apply full system pressure and close the bypass valve (tighten the screw).

b. Cylinder Adjustment - If either of the kidney lift cylinders reaches the end of the down stroke before the other one, an adjustment is needed. Use the following procedure to adjust the system.

1. If the right side bottoms out before the left side, open the bypass valve and activate "KIDNEY DOWN" to align the cylinders.

2. If the left side bottoms out before the right side, activate "KIDNEY UP" to raise the cylinders. When the cylinders are at the full up position, open the valve and activate "KIDNEY UP" to align the cylinders. Close the valve before lowering the cylinders.

3. When the adjustment is complete, make sure the cylinders are completely down, activate "KIDNEY DOWN" and tighten the valve.

SECTION IV ELECTRICAL SYSTEM

4-1. General

The complete electrical system (with the exception of the hand-held pendant control and the return circuit micro-switches) is contained within the base of the table. The pump motor and the hydraulic valves are controlled electrically with the pendant control.

The electrically operated functions are as follows:

- TRENDELENBURG - Head up and down
- LATERAL TILT - Right and left
- BACK SECTION - Up and Down
- ELEVATION - Up and Down
- TOP SLIDE
- LEG SECTION - Up and Down
- FLEX / REFLEX
- KIDNEY LIFT - Up and down
- RETURN TO LEVEL
- BRAKE UNLOCK - Brake release

The power requirements are 120 VAC, 60 Hz, fuse protected. The main power on-off switch is an enclosed DPST type and the power cord is a three-wire, fifteen foot long, UL listed cord with a three-prong hospital grade plug.

4-2. Components

Refer to figure 4-1 for the relationship of the electrical components.

a. Wires, Connectors, Switches, Fuse - These provide the path for the various electrical circuits.

b. Relay Box - Contains the step down transformer, full wave rectifier, and relay switches. The relay switches are activated by the pendant control and in turn energize the solenoid.

c. Hand-Held Pendant Control - Closes micro-switches to activate relay box. Operates on 5 VDC.

d. Solenoids - These electrically open and close the hydraulic ports of the mini-valve to direct the fluid to the correct cylinders. They operate on 120 VAC.

e. Motor/Pump Assembly - 120 VAC, 60 HZ, 200 Watt capacitor induction motor.

4-3. Battery Model Components

The functions of the battery model tables are the same as the standard 120 VAC models. The electrical components and operation however, vary greatly between the two models. To simplify the troubleshooting procedures, the battery model tables are covered separately in Section VI.

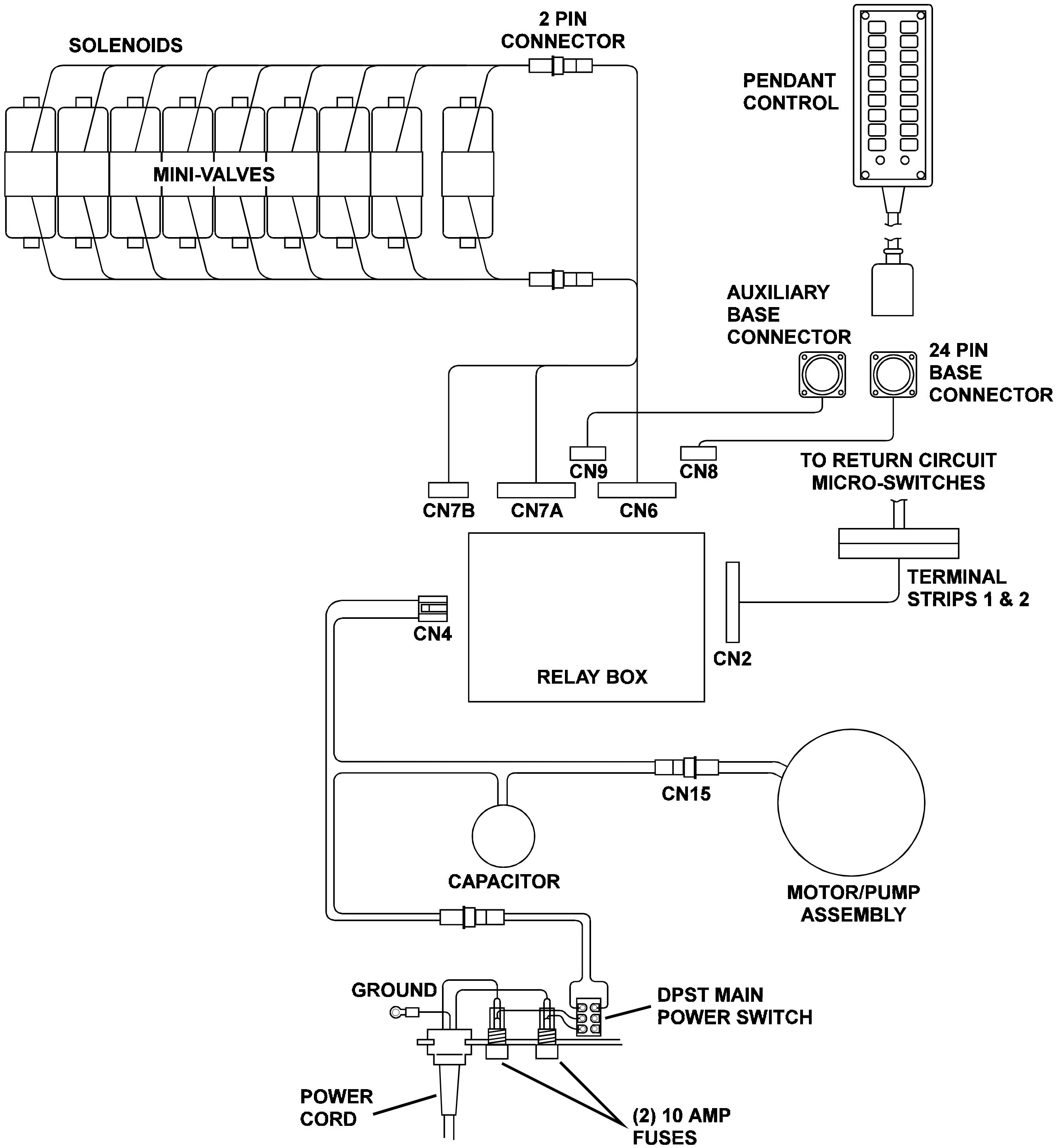


Figure 4-1. 3500 Electrical Circuit Block Diagram

SECTION V ELECTRICAL SYSTEM TROUBLESHOOTING

5-1. Troubleshooting Notes

The basic operation of each component will be defined along with a drawing and explanation on how to check it out.

Certain defective components could cause the entire table to stop functioning or only one control function to stop. It would depend on what part of the component failed. Other defective components would only cause one control function to stop.

The following defective components could cause all control functions to be affected:

a. Motor/Pump Assembly (starting capacitor)
b. Main Switch Circuit and Wiring

The following defective components could cause all control functions to be affected or only one control function:

a. Relay Box
b. Pendant Control

The component listed below would only affect one control function:

Solenoid

When troubleshooting an electrical circuit, start at the problem and work back to the power source.

5-2. Main Switch

The main power supply, 120 VAC, 60 HZ, comes in through the power cord and through the main switch. The main switch opens both lines when in the "OFF" position. Two 10 amp fuses are used to protect the complete electrical system and are located next to the main switch.

a. Main Switch Test

The following test will determine if line voltage is applied to connector CN4, which in turn would power the table.

1. Plug the power cord into the 120VAC power supply (wall receptacle) and turn ON the main switch.

2. Disconnect connector CN4 from the relay box. See figure 5-1. Leave all other connectors connected.

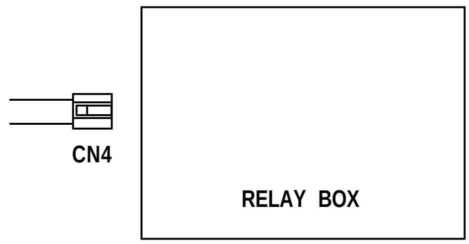
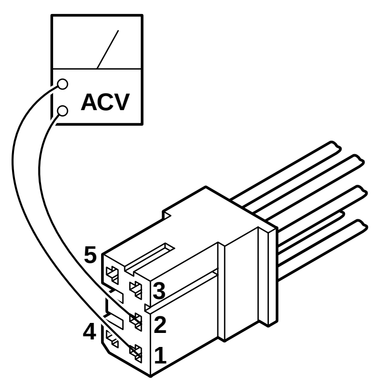


Figure 5-1. Main Power Test

CAUTION

Line voltage (120 VAC) will be measured in this test. Do not touch uninsulated connector pins or meter test leads.

3. Use an AC voltmeter capable of measuring 120 VAC and measure the voltage between pins 1 and 2 (black and white wires) located in connector CN4. See figure 5-2. You should receive line voltage 120 VAC.



PIN NO.	COLOR
1	White
2	Black
3	Red
4	Blue
5	Yellow

Figure 5-2. Connector CN4

b. Test Results

If you do not receive the correct voltage measurement, the problem would have to be in the wires, main switch, fuses, or power cord. If the correct voltage is obtained, everything is good up to this point and the problem would have to be in another area.

5-3. Pendant Control

The Pendant Control consists of 18 micro-switches (buttons). When any of the circuits are completed (by depressing a control button) the appropriate relay contacts (located in the relay box) close applying 120V potential to the appropriate solenoid to operate the mini-valve and the pump/motor. The Pendant Control has only 5-6 volts applied to it.

a. Pendant Control Test

The following test will determine if the micro-switches inside the Pendant Control are function-ing correctly.

1. Unplug the pendant control from the base of the table. You will be checking the cord side connector.

2. Use an ohmmeter R x 1 scale and check the continuity between pin 1 and pins 4 through 24. See figure 5-3.

3. Ohmmeter must show continuity between the pins that are indicated when the appropriate buttons are pressed.

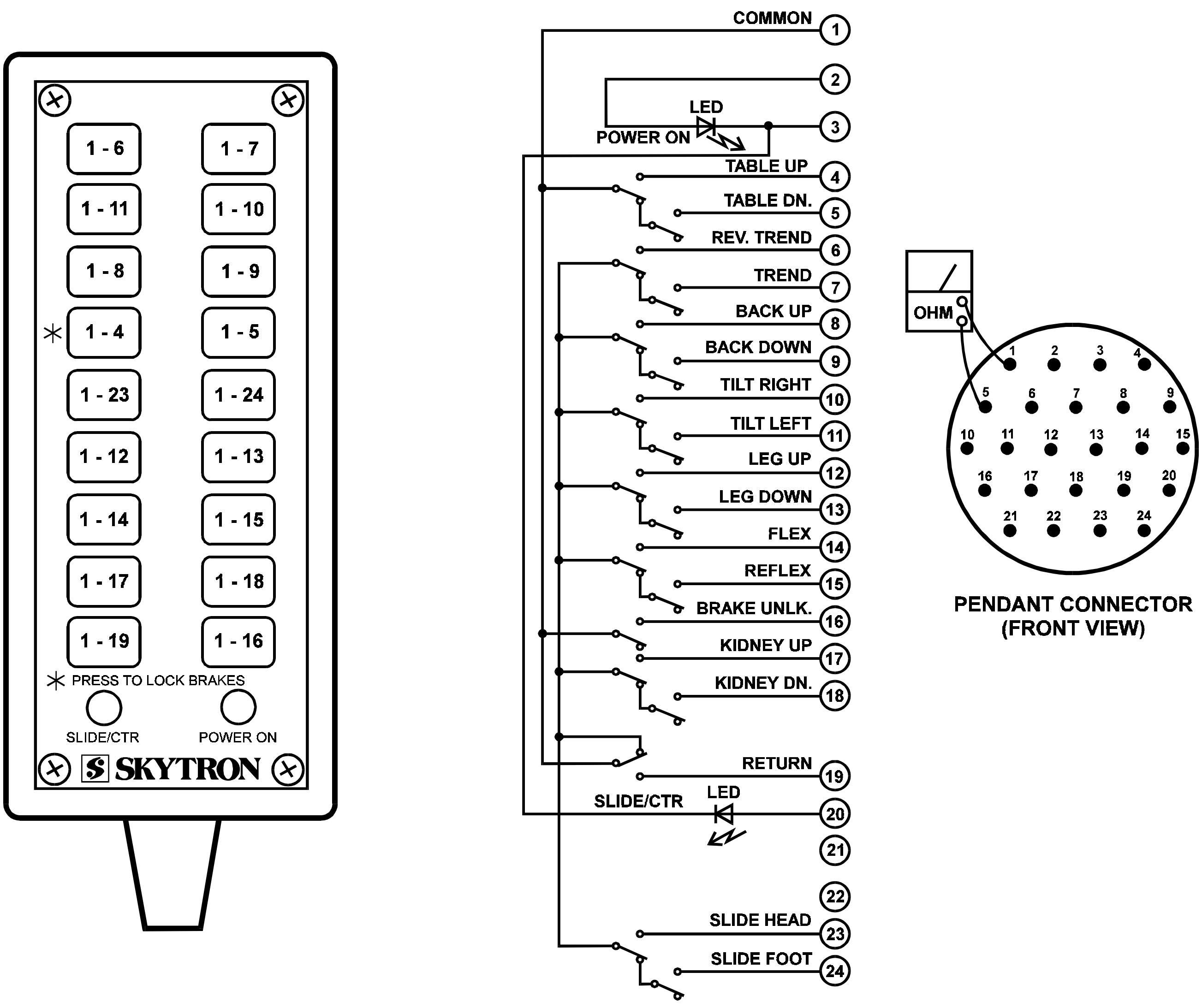


Figure 5-3. Pendant Control Test

NOTE

Pins 2 and 3 are connected to the green LED (power ON light on the pendant control) and pin 20 is connected to the amber LED (slide center light on the pendant control) these pins cannot be checked with an ohmmeter.

b. Test Results:

If you do not receive continuity between any of the pins, either the micro-switch in the Pendant Control is defective or a wire is broken. Either of these problems can be repaired easily.

If you receive correct readings with the meter, the Pendant Control is okay.

c. Wiring Harness Test

The following test checks the wires leading from the relay box connector CN8 to the 24 pin connector table socket. These wires apply low voltage to the pendant control buttons.

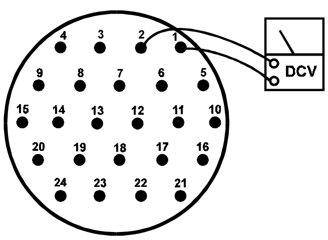
1. The power cord should be plugged into the wall socket and the main switch turned ON.

2. Disconnect the pendant control from the base connector. All other connectors should be connected.

3. Use a DC voltmeter 10V scale and measure the following pins located in the 24 pin table base connector. See figure 5-4.

NOTE

Pin 19 in table base connector will have no voltage potential unless 1 of the return-to-level micro-switches are activated, i.e. trendelenburg, tilt, etc.

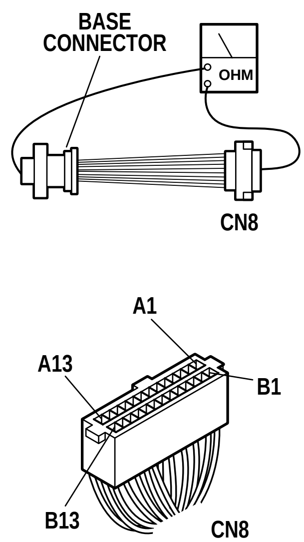


+ TEST LEAD	- TEST LEAD	DC VOLTS
1	2, 3, 21, 22	0
1	4 - 20, 23, 24	5 - 6

Figure 5-4. Table Base Connector

d. Test Results:

If you do not receive the correct voltage reading, the wiring or connector pins may be faulty. Disconnect connector CN8 from the relay box and using an ohmmeter, test the continuity between the corresponding pins in connectors CN8 and the table base connector. See figure 5-5. If the correct readings are obtained, this part of the circuit is okay.



BASE CONN.	COLOR	CN8
1	Red/White	A1
2	White	B1
3	Black	A2
4	Red	B2
5	White/Red	A3
6	Yellow	B3
7	Brown	A4
8	White/Brown	B4
9	Blue/Whte	A5
10	Orange	B5
11	White/Orange	A6
12	Gray	B6
13	White/Gray	A7
14	White/Yellow	B7
15	Purple/White	A8
16	Black/White	B8
17	Purple	A9
18	White/Purple	B9
19	Blue/Yellow	A10
20	Blue/Red	B10
21		A11
22		B11
23	Blue	A12
24	White/Blue	B12
		A13
		B13

Figure 5-5. Base Connector Continuity Test

5-4. Relay Box

The 120 volt power supply is directly connected to the relay contacts. When these contacts are closed, 120 volts is supplied to the solenoids which are mounted on the hydraulic mini-valves. One relay is used to supply 120V to the pump/motor and is always activated no matter what control function is selected. The brake locking circuit relay is also activated when any control function other than BRAKE UNLOCK is *initially* selected.
Also, inside the relay box is a step-down transformer and full-wave rectifier which decreases the line voltage to 5.5 volts. This low voltage potential controls the relays by the use of the hand-held pendant control buttons. Basically the relays enable a 5.5 volt potential to control the 120 volt circuit. The following tests will determine if the relay box is functioning correctly.

a. Relay Box Input Connector CN4

1. Plug the power cord into the 120 VAC power supply (wall receptacle) and turn the main switch ON. Leave all connectors connected.

CAUTION

Line voltage (120 VAC) will be measured in this test. Do not touch uninsulated connector pins or meter test leads.

2. Use an AC voltmeter capable of measuring 120 volts and measure the voltage between pins 1 (white) and 2 (black) of connector CN4 for input voltage. See figure 5-6. Meter should read line voltage 120 VAC.

3. Activate any table function with the Pendant Control and using an AC voltmeter, test the voltage at pins 3 and 4 of CN4 for output to the pump. Meter should read 120 VAC.

PIN NO.	COLOR
1	White
2	Black
3	Red
4	Blue
5	Yellow

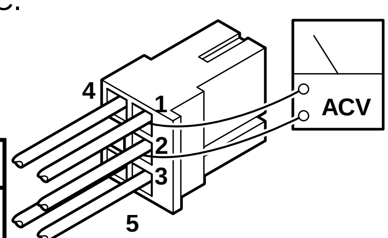


Figure 5-6. Connector CN4

b. Test Results:

If you do not receive the correct meter readings, the relay box or wiring is defective. If the correct readings are obtained, this part of the relay box is okay. Proceed to the next step.

c. Relay Box Output Connector CN8

This test checks the low voltage applied to the pendant control buttons.

1. The power cord should be plugged into the wall receptacle and main switch turned ON.

2. Disconnect Pendant Control connector. All other connectors should be connected.

3. Using a DC voltmeter, measure the voltage between pin 1(+) and pins 4 through 24 (-) of the table base connector. See figure 5-4. Meter should read 5-6 volts.

d. Test Results:

If you do not receive the correct meter readings, the relay box or wiring is defective. If the correct readings are obtained, this part of the relay box is okay. Proceed to the next step.

e. Relay Box Output Connectors CN6, CN7A & CN7B

This test checks the high voltage (120V) that is used to energize the solenoids.

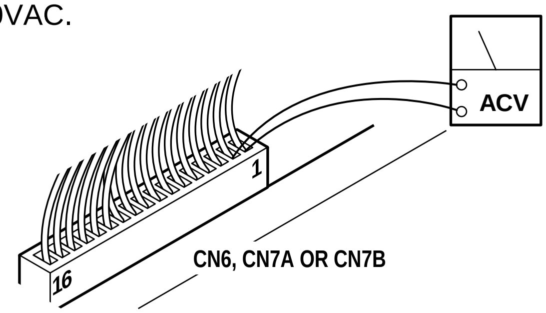
CAUTION

120 VAC will be measured in this test. Do not touch uninsulated connector pins or meter test leads.

1. The power cord should be plugged into the wall receptacle and main switch turned ON.

2. Disconnect the motor connector CN15. All other connectors should be connected. Test connectors CN6, CN7A and CN7B from the back while attached to the relay box.

3. Activate each of the Pendant Control buttons and using an AC voltmeter capable of measuring 120VAC, measure the voltage between the appropriate connector pins located in connector CN6, CN7A or CN7B. See figure 5-7. Polarity of meter test leads is not important. Meter should read 120VAC.



CN6		CN7A	
FUNCTION	PINS	FUNCTION	PINS
Table Up	1 - 2	Leg Up	1 - 2
Table Down	3 - 4	Leg Down	3 - 4
Rev Trend	5 - 6	Kidney Up	5 - 6
Trend	7 - 8	Kidney Down	7 - 8
Back Up	9 - 10	Brake Set	9 - 10
Back Down	11 - 12	Brake Unlock	11 - 12
Tilt Right	13 - 14	Flex	13 - 14
Tilt Left	15 - 16	Reflex	15 - 16
		CN7B	
		Slide Head	1 - 2
		Slide Foot	3 - 4

Figure 5-7. Relay Box Output Connectors CN6 and CN7

f. Test Results:

If you do not receive the correct meter readings, the relay box or wiring is defective and should be replaced.

NOTE

Before deciding the relay box is defective, check the wires and pins in the connector blocks to make sure they are not loose or making a bad connection with their mate.

5-5. Solenoids

The solenoids are energized by 120 volt potential that is controlled by the relays located inside the relay box.

The solenoid windings are protected from excessive heat with an internal thermal fuse that will open after approximately seven (7) minutes of continuous operation. The solenoid must be replaced if the internal thermal fuse has been blown. The solenoids are mounted directly on either side of the hydraulic mini-valves and push the spool valve in one direction or the other depending upon which solenoid is activated.

a. Solenoid Test

The following tests check the voltage applied to the solenoids and the resistance of the solenoid coil.

NOTE

If a solenoid does not function when the pendant control button is pushed, the problem could be the pendant control, the relay box, or the solenoid.

NOTE

Each solenoid is controlled with 120V source coming from the relay box. This source can easily be checked by measuring the voltage at the 2 pin connector in question.

CAUTION

Line voltage will be measured in this test. Do not touch uninsulated connector pins or meter test leads.

b. Step #1

1. Plug the table cord into the wall receptacle and turn main switch ON.

2. Disconnect the 2 pin connector from the solenoid in question. See figure 5-8.

3. Use a voltmeter capable of measuring 120 VAC and measure the voltage across the 2 pin connector. Polarity of meter leads is not important.

NOTE

The appropriate pendant control button must be pushed during this test. The motor will run when this test is performed, and the brake locking solenoid will be activated by any function other than UNLOCK if brakes are not set.

c. Test Results:

If you do not receive the correct voltage, the problem could be in the wires leading to connectors CN6, CN7A and CN7B. The problem could also be in the relay box or the Pendant Control (refer to appropriate section for troubleshooting).

If the correct voltage is obtained, everything is good up to that point and the problem is more than likely the solenoid.

d. Step #2

The solenoid can be checked out using an ohmmeter R x 1 scale.

1. Measure the resistance between the two pins of the connector in question. See figure 5-8. Connector being tested must be disconnected. Polarity of meter leads is not important.

2. The meter should read approximately 80-90 ohms at room temperature (58 ohms for tables S.N. 1997-4&L).

3. Measure the resistance between either pin and solenoid housing.

4. Meter should read infinity.

e. Test Results:

If the solenoid does not check out with the meter, it is more than likely defective and must be replaced.

NOTE

> Whenever there are several components of the same type, a defective unit can also be detected by substituting a known good unit or wire connector. In some cases this may be faster than using a multi-meter.

5-6. Motor/Pump Assembly

The electric motor is a capacitor start type with a rating of 120 VAC, 200 watts. The field windings are protected with a thermal protector that will open the winding circuit if the motor is run continuously for approximately 10 minutes. This protector will take about 10 minutes to automatically reset. The oil pump unit is attached to the bottom of the motor and is a gear type displacement pump with a pumping capacity of .4 liter per min. The Motor/Pump Assembly is mounted on an insulated motor plate in the base of the table. The starting capacitor is mounted along side the motor/pump assembly.

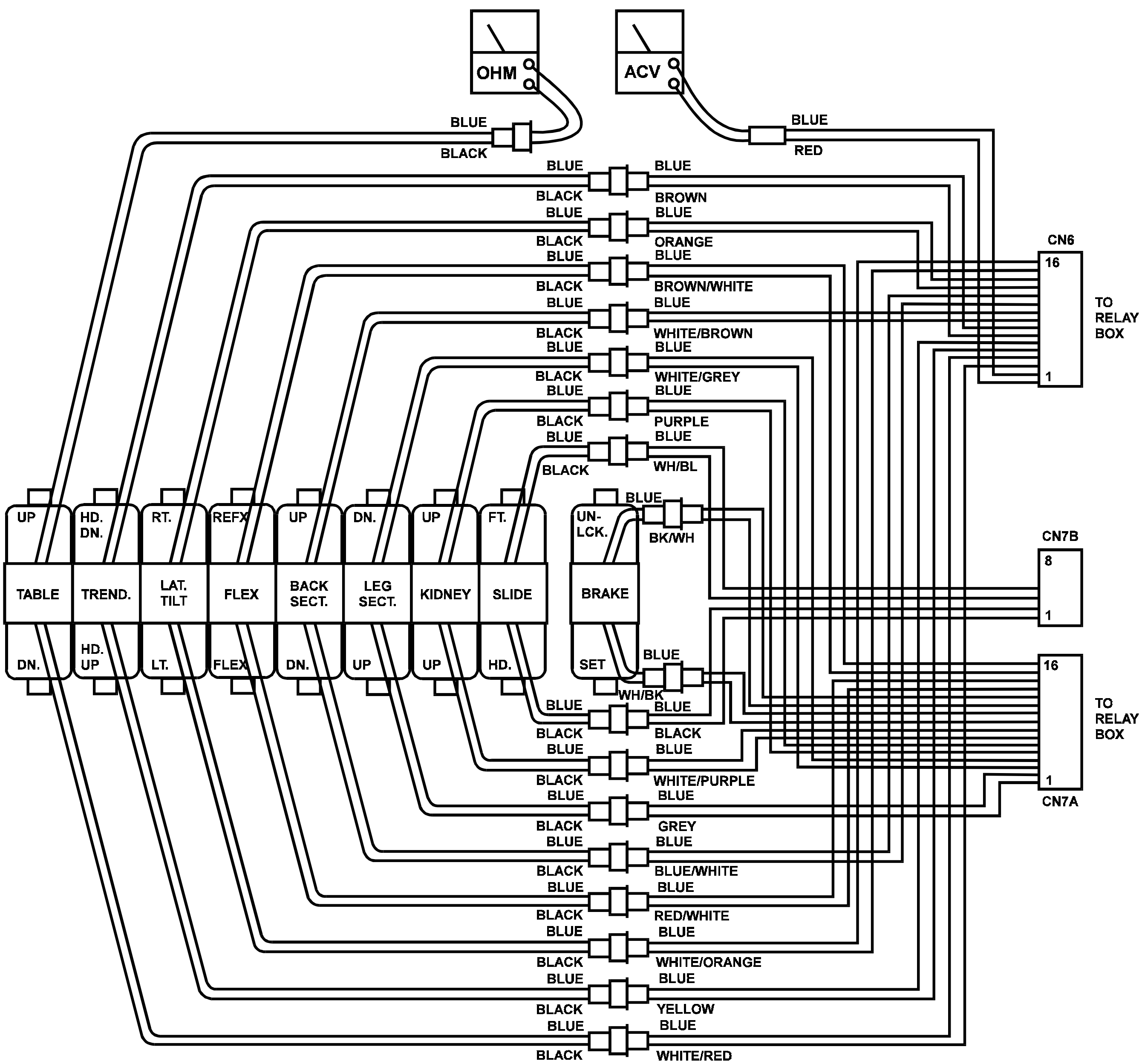


Figure 5-8. Solenoid Test

a. Motor/Pump Test

The following tests will check the voltage applied to the motor and the resistance of the motor field windings.

CAUTION

Line voltage will be measured in this test. Do not touch uninsulated connector pins or meter test leads.

b. Step #1

1. Plug the power cord into 120 VAC power supply (wall receptacle). Turn main switch ON.

2. Disconnect the 3 pin connector CN15 at the motor. Leave all other connectors connected. See figure 5-9.

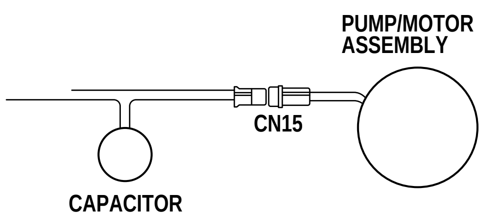
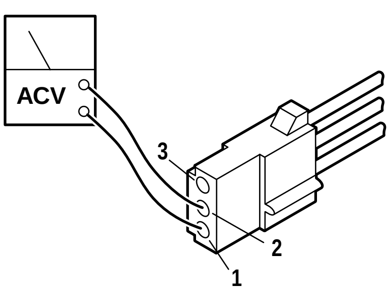


Figure 5-9.

3. Use a voltmeter capable of measuring 120 VAC and measure the following connector pins in connector CN15. See figure 5-10.



PIN NO	AC VOLTS
1 - 2	120
1 - 3	120
2 - 3	0

Figure 5-10. Connector CN15

c. Test Results:

If you do not receive the correct meter readings, the problem could be in the wires, connectors, relay box, or main switch (refer to appropriate section for troubleshooting).

If the correct voltage is obtained, everything is good up to that point and the problem could be either the motor or the starting capacitor.

d. Step #2

If the starting capacitor is shorted or grounded, the motor will not run. Capacitors very seldom fail, and it requires a dielectric tester to accurately test one. However, an ohmmeter can be used to determine if the capacitor will store a low voltage charge and most of the time this is adequate.

1. Turn the main switch OFF.

2. Connector CN15 should be disconnected.

3. Use the R x 100 scale of the ohmmeter and touch pins 2 and 3 of connector CN15. See figure 5-10.

e. Test Results:

The meter needle should move up scale and then back down to infinity. This would indicate that the capacitor is storing an electrical charge.

NOTE

The capacitor may have to be discharged first (by shorting pins 2 and 3 together) before you will be able to see the ohmmeter needle swing up the scale.

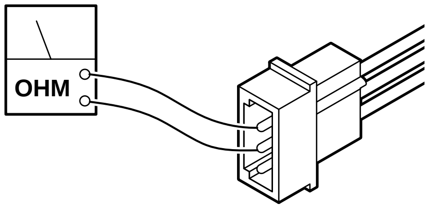
f. Step #3

The motor windings can be statically checked for resistance using an ohmmeter.

1. Turn main power switch OFF.

2. Connector CN15 should be disconnected.

3. Use the R x 1 scale of the ohmmeter and measure the resistance between the pins located in the pump connector CN15. See figure 5-11.



PIN NO	METER
1 - 2	Approx. 5 ohms
1 - 3	Approx. 4 ohms
2 - 3	Approx. 8 ohms

Figure 5-11. Pump Connector CN15

g. Test Results:

If you do not receive the correct meter readings, the motor or wiring is defective.

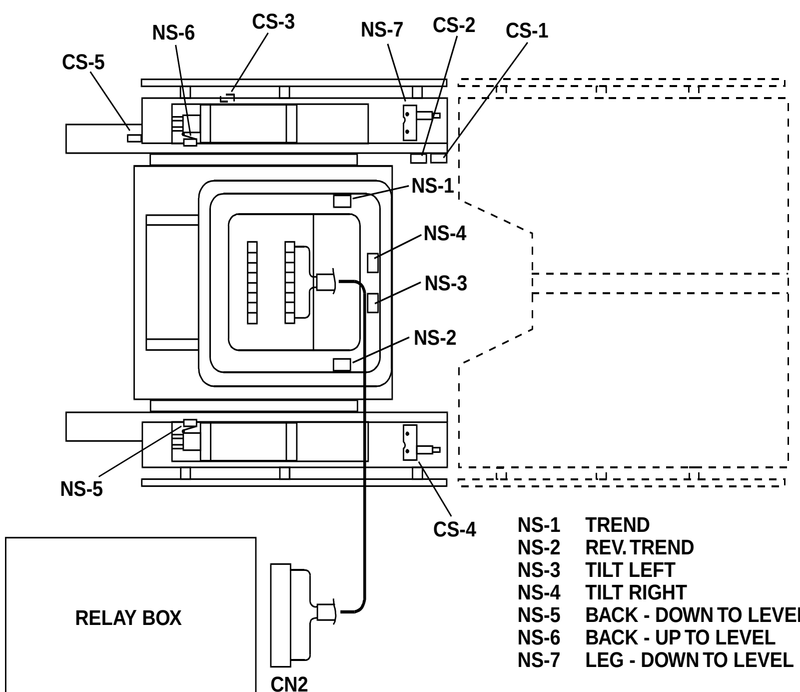
5-7. Return-to-Level Micro-Switches.

The return-to-level feature is activated by a single button on the pendant control and automatically levels the major table functions, lateral tilt, trendelenburg, flex, back section, and leg section.

The kidney lift has a back section-up inhibit switch to prevent the table back section from damaging the kidney lift when the lift is raised. The back section still has the capability to be lowered and raised, but will not raise more than 45° above horizontal until the kidney lift is completely down. If the back section is raised more than 45° above horizontal, the system will not allow the kidney lift to be raised.

The slide function has inhibit switches to prevent damage to the back and leg sections. If the back section is below horizontal the top will not slide toward the foot end. If the leg section is lowered more than 45° below horizontal the top will not slide toward the head end. Likewise, if the top is slid toward the foot end, the back section will not go below horizontal. If the top is slid toward the head end, the leg section will not go more than 45° below horizontal.

The return-to-level/inhibit system consists of 12 micro-switches, an electrical connector, 2 terminal strips and the related wiring. The micro-switches are mounted on or adjacent to the function they control and are wired for normally open or normally closed operation. The micro-switches are cam or lever actuated and can be adjusted at the individual switch mounting brackets. See figure 5-12.



NS-1 TREND
NS-2 REV. TREND
NS-3 TILT LEFT
NS-4 TILT RIGHT
NS-5 BACK - DOWN TO LEVEL / SLIDE INHIBIT
NS-6 BACK - UP TO LEVEL
NS-7 LEG - DOWN TO LEVEL

CS-1 SLIDE/LEG DOWN INHIBIT
CS-2 SLIDE/BACK DOWN INHIBIT
CS-3 KIDNEY/BACK 45° UP INHIBIT
CS-4 LEG DOWN 45°/SLIDE INHIBIT
CS-5 BACK UP 45°/KIDNEY UP INHIBIT

Figure 5-12.

The micro-switches operate on low voltage, and control the function circuits (pump/motor and appropriate solenoid valves) when activated by the pendant control RETURN button.

The micro-switches are wired to the relay box through 2 terminal strips, a riser cord and the 15 pin connector CN2. See figure 5-12 for switch location and identification.

5-8. Return/Inhibit System Troubleshooting

If a problem is suspected in the return circuits, disconnect the connector CN2 from the Relay Box to eliminate the circuits. Ensure that all table functions operate properly using the Pendant Control. If the functions do not work properly using the Pendant Control, refer to the appropriate test section and make all needed repairs before working on the return circuits.

NOTE

It is normal for the back section to move up if the RETURN button is pushed when connector CN2 is disconnected from the relay box.

All of the micro-switches are connected to the relay box via a wiring harness and the micro-switch riser cord from terminal strips 1 and 2 to connector CN2. The terminal strips are located under the hose cover on the top of the elevation column. Connector CN2 plugs into the relay box and is the most convenient location to make circuit continuity checks. See fig. 5-13 for connector pin locations.

a. Switch Test

Turn Main Power ON, lock the table brakes, and place the table top sections in a level position with the Kidney Lift down. Disconnect connector CN2 from the relay box and using an ohmmeter, test the wiring and switch operation at the appropriate pin numbers for the micro-switch in question as shown in figures 5-14 through 5-21.

NOTE

Be sure to isolate the circuit when making continuity checks.

NOTE

If you do not receive the proper continuity results at connector CN2 it does not necessarily mean the micro-switch is defective. There could be a problem with the riser cord between connector CN2 and terminal strips 1 and 2, or in the wiring from the switch to the terminal strips. Further tests will have to be made to determine the exact problem.

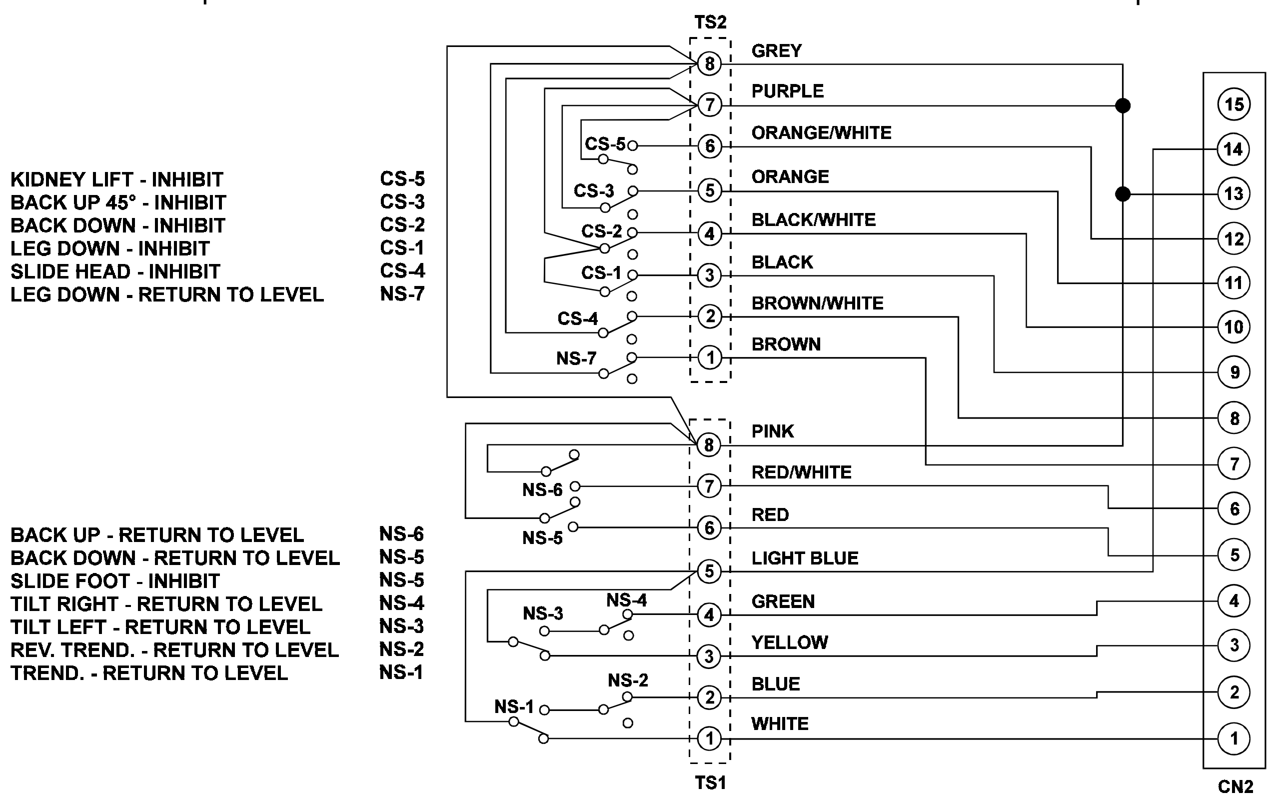
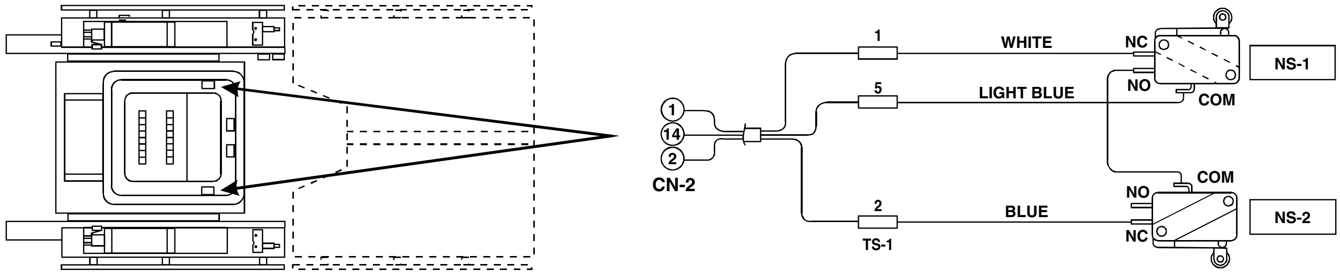


Figure 5-13. Return / Inhibit Micro-Switch Test



NS-1. Trendelenburg
Test at pins 1 & 14

Table Position	Switch Position	Meter Reading
Level	Open	Infinity
Head Up	Open	Infinity
Head Dn	Closed	0

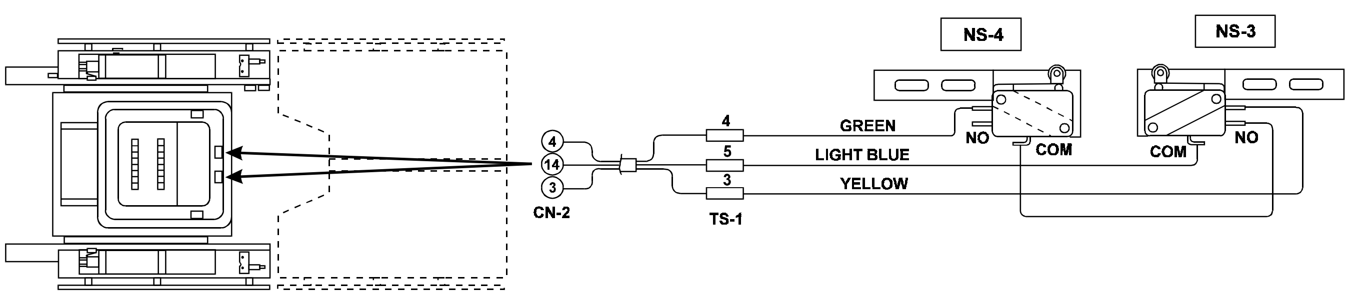
When table is in Trendelenburg Position, NS-1 brings the top back to level.

NS-2. Reverse Trendelenburg
Test at pins 2 & 14

Table Position	Switch Position	Meter Reading
Level	Open	Infinity
Head Up	Closed	0
Head Dn	Open	Infinity

When table is in Reverse Trendelenburg Position, NS-2 brings the top back to level.

Figure 5-14. Trendelenburg Return Switches



NS-3. Lateral Tilt-Left
Test at pins 3 & 14

Table Position	Switch Position	Meter Reading
Level	Open	Infinity
Tilt Right	Open	Infinity
Tilt Left	Closed	0

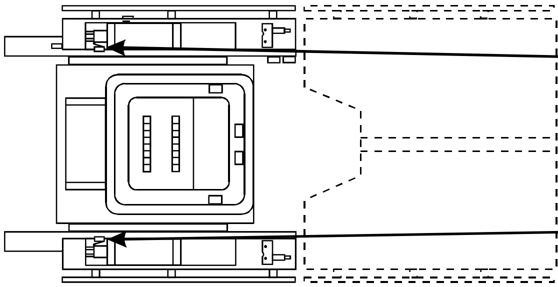
When table is inTilt-Left Position, NS-3 brings the top back to level.

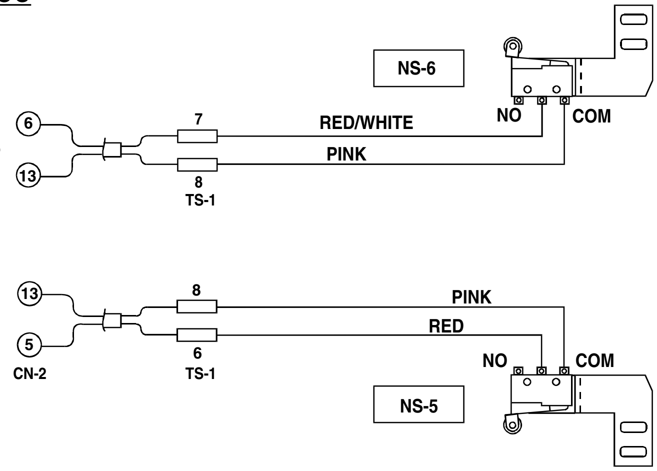
NS-4. Lateral Tilt-Right
Test at pins 4 & 14

Table Position	Switch Position	Meter Reading
Level	Open	Infinity
Tilt Right	Closed	0
Tilt Left	Open	Infinity

When table is in Tilt-Right Position, NS-4 brings the top back to level.

Figure 5-15. Lateral Tilt Return Switches





NOTE
When CN-2 is disconnected, BACK-DOWN function will not operate.

NS-5. Back Section Down
Test at pins 5 & 13

Table Position	Switch Position	Meter Reading
Level Back Dn Back Up	Closed Open Closed	0 Infinity 0

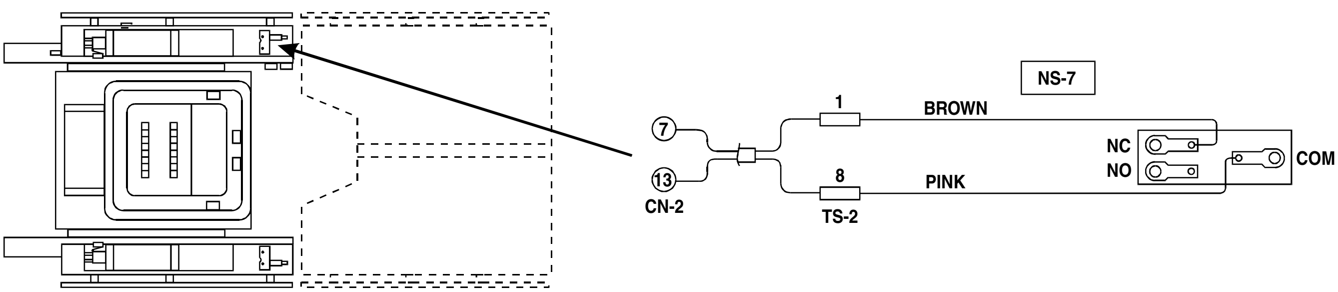
When the Back Section is Down, NS-5 brings the Back Section Up to level and will not allow Top Slide toward foot.

NS-6. Back Section Up
Test at pins 6 & 13

Table Position	Switch Position	Meter Reading
Level Back Dn Back Up	Open Open Closed	Infinity Infinity 0

When the Back Section is Up, NS-6 brings the Back Section Down to level.

Figure 5-16. Back Section Return Switches

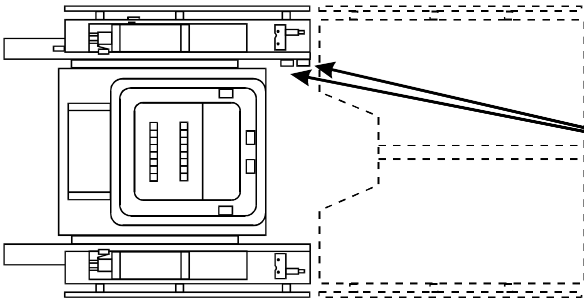


NS-7. Leg Section Down
Test at pins 7 & 13

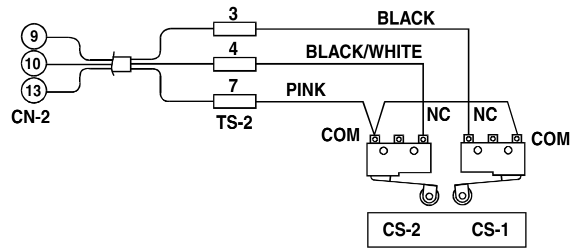
Table Position	Switch Position	Meter Reading
Level Leg Dn	Open Closed	Infinity 0

When the Leg Section is Down, NS-7 brings the Leg Section Up to level.

Figure 5-17. Leg Section Return Switch



NOTES
SLIDE function will not operate when CN-2 is disconnected.



CS-1. Leg Down 45° Inhibit
Test at pins 9 & 13

Table Position	Switch Position	Meter Reading
Center	Closed	0
Slide Hd	Closed	0
Slide Ft	Open	Infinity

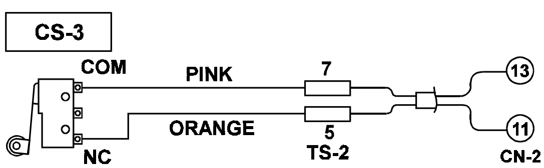
When Top is slid toward head, CS-1 will not allow Leg Section to go more than 45° below horizontal.

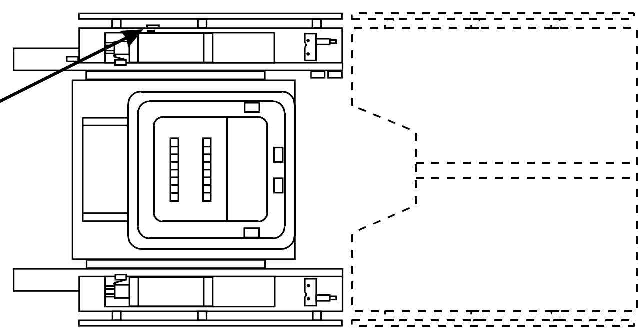
CS-2. Back Down Inhibit
Test at pins 10 & 13

Table Position	Switch Position	Meter Reading
Center	Open	Infinity
Slide Hd	Closed	0
Slide Ft	Open	Infinity

When Top is slid toward foot, CS-2 will not allow Back Section to go below horizontal.

Figure 5-18. Leg Down / Back Down Inhibit Switches



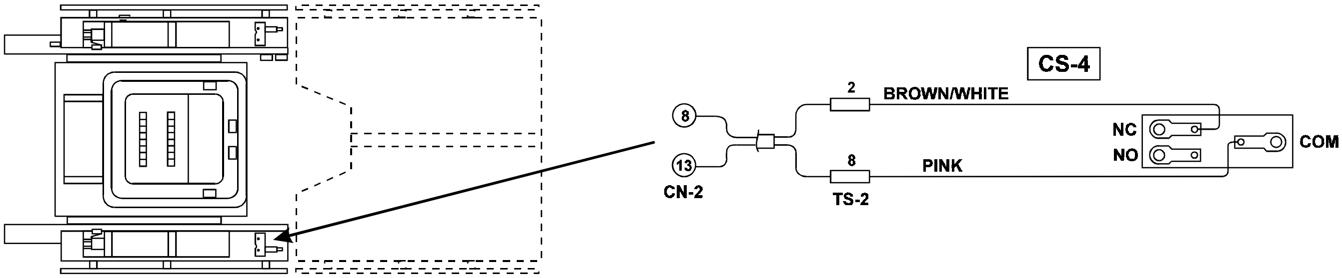


CS-3. Back Up Inhibit Switch
Test at pins 11 & 13

Table Position	Switch Position	Meter Reading
K-Lift Dn	Open	Infinity
K-Lift Up	Closed	0

When K-Lift is Up, CS-3 will not allow Back Section to go more than 45° above horizontal.

Figure 5-19. Back Up Inhibit Switch

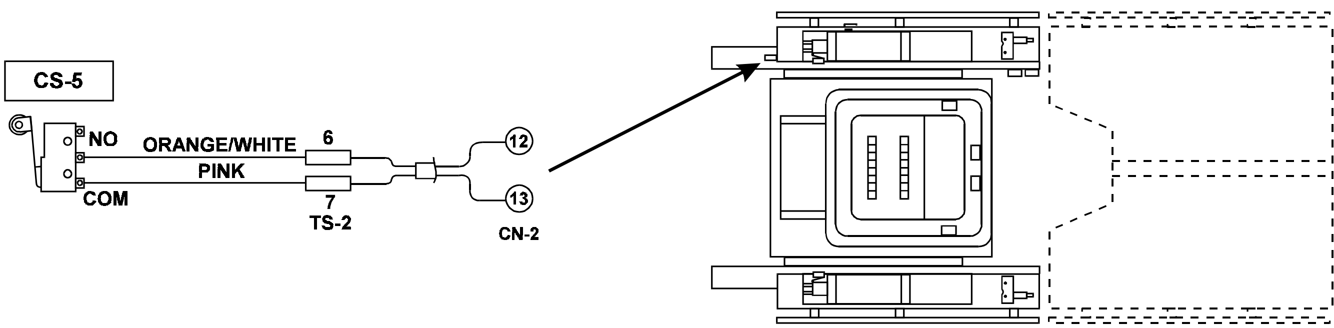


CS-4. Slide Inhibit
Test at pins 8 & 13

Table Position	Switch Position	Meter Reading
Level Leg Dn more than 45°	Open Closed	Infinity 0

When Leg Section is more than 45° below horizontal, CS-4 will not allow Top to Slide toward head.

Figure 5-20. Slide to Head Inhibit Switch



CS-5. Slide Inhibit
Test at pins 12 & 13

Table Position	Switch Position	Meter Reading
Back Up Less Than 45° Back Up More Than 45°	Open Closed	Infinity 0

When Back Section is more than 45° above horizontal, CS-5 will not allow Kidney Lift to operate.

Figure 5-21. Kidney Lift Inhibit Switch

b. Switch Adjustment.

If proper readings are not obtained during test or if table does not properly return to level, use the following procedure to adjust the switches.

1. Apply table brakes and (using a level) level the table top using the TRENDELENBURG and LATERAL-TILT function buttons on the pendant control.

2. For all switches except the Leg Section switches, carefully loosen the switch retaining screws, and adjust the switches as needed. See figure 5-22.

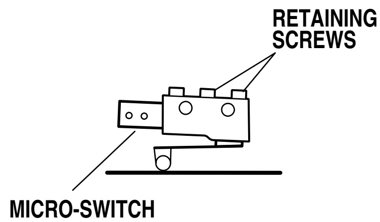


Figure 5-22. Micro-Switch Adjustment

3. To adjust the Leg Section switches remove seat section top, loosen the two Phillips head screws securing the bracket, adjust the switch, tighten screws and replace seat section top. See figure 5-23.

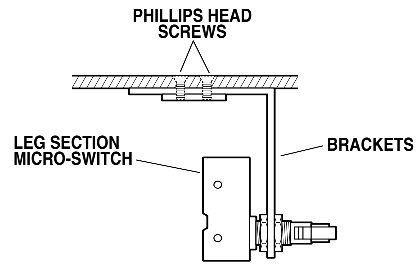


Figure 5-23. Leg Section Micro-Switch Adjustment.

SECTION VI -3500B- BATTERY MODEL, ELECTRICAL TROUBLESHOOTING

6-1. General

The battery table components operate on 24VDC. The internal charging system also incorporates the components to transform the 120VAC input to 24VDC output to the components.

6-2. Troubleshooting Notes

The basic operation of each component will be defined along with a drawing and explanation on how to check it out.

Certain defective components could cause the entire table to stop functioning or only one control function to stop. It would depend on what part of the component failed. Other defective components would only cause one control function to stop.

The following defective components could cause all control functions to be affected:

a. Motor/Pump Assembly
b. Main Switch Circuit and Wiring

The following defective components could cause all control functions to be affected or only one control function:

a. Relay Box
b. Pendant Control

The component listed below would only affect one control function:

Solenoid

When troubleshooting an electrical circuit, start at the problem and work back to the power source.

NOTE

On the battery model tables, troubleshooting should begin by switching the operating mode. For example; if a function fails when attempting to operate the table in the AC120V mode, switch to the BATTERY mode. If the function now operates, the problem is probably located between the power cord and the relay box. If the function also fails when in battery operation, use the auxiliary switches to operate the function. If the function now operates, the problem is probably in the pendant control, connectors or wiring from the pendant control to the relay box. All connector pins are numbered usually with very small numbers.

6-3. Main Switch

The main power supply, 120 VAC, 60 HZ, comes in through the power cord and through the main switch. The main switch opens both lines when in the "OFF" position. Two 10 amp fuses are used to protect the complete electrical system and are located next to the main switch.

a. Main Switch Test

The following test will determine if line voltage is applied to connector CN12, which in turn would supply 120VAC power to the table.

1. Plug the power cord into the 120VAC supply (wall receptacle) and turn the main switch ON.

2. Disconnect connector CN12. See figure 6-2. Leave all other connectors connected.

CAUTION

Line voltage (120 VAC) will be measured in this test. Do not touch uninsulated connector pins or meter test leads.

3. Use an AC voltmeter capable of measuring 120 VAC and measure the voltage between pins 1 and 2 (black and white wires) located in connector CN12. See figure 6-1. You should receive line voltage 120 VAC.

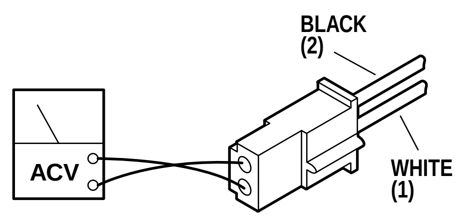


Figure 6-1. Connector CN12 Test

b. Test Results

If the correct voltage is obtained, everything is good up to this point and the problem would have to be in another area.
If you do not receive the correct measurements, the problem would have to be in the wires, main switch, fuses, or power cord.

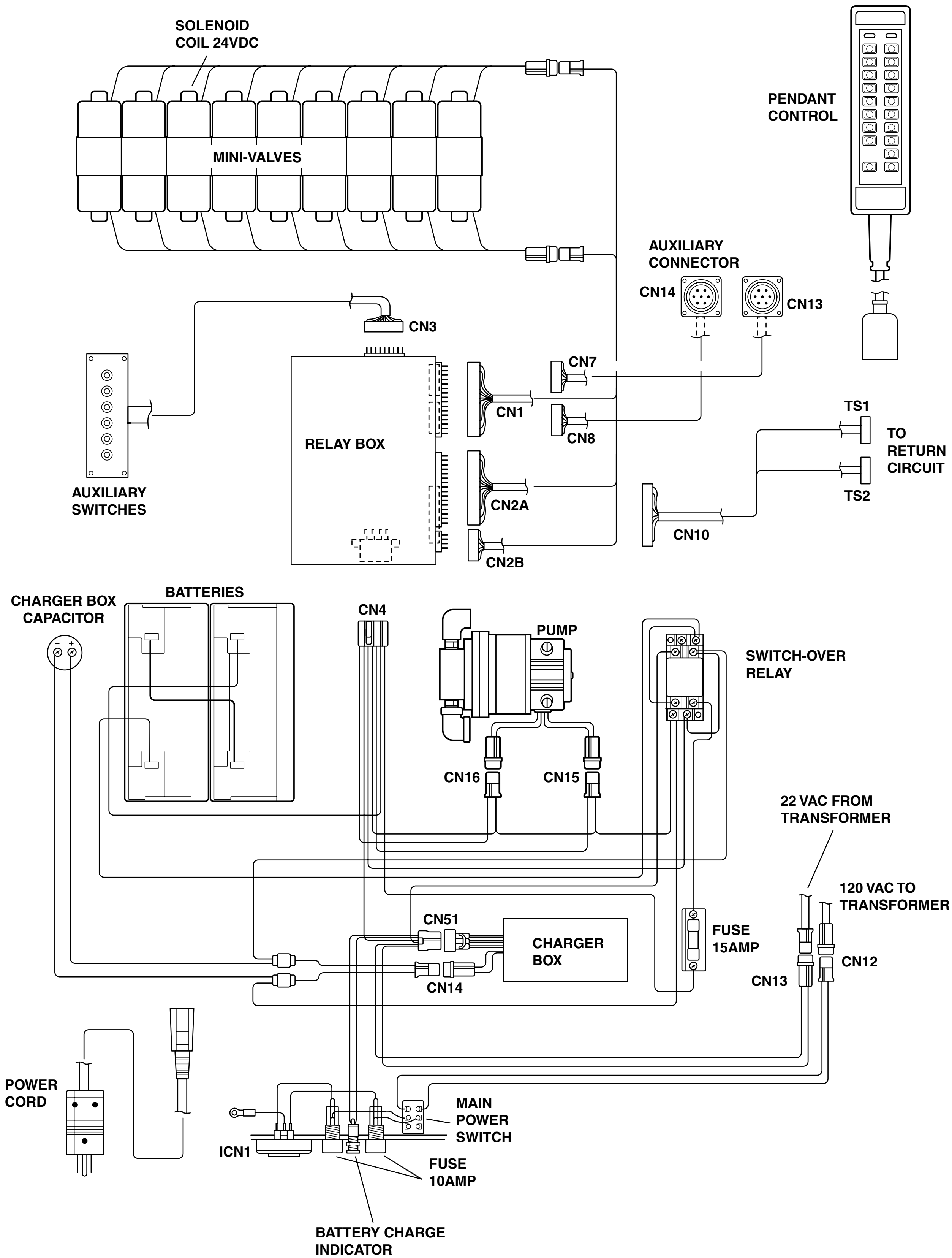


Figure 6-2. Electrical Circuit Block Diagram, Model 3500B

Check the continuity from the power cord connector ICN1, through the fuses, switch and wiring to connector CN12. Remove the power cord, disconnect CN12 (black and white wires), and test as shown in figure 6-3.

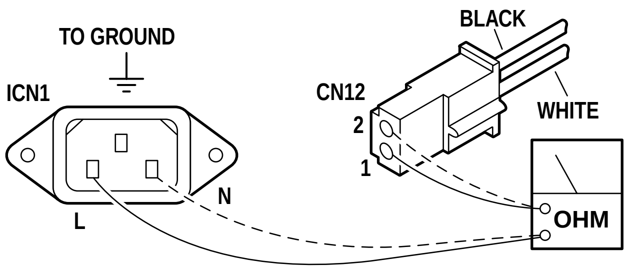


Figure 6-3. CN12 to ICN1 Continuity Test

4. Continue to press the TABLE UP button on the pendant control so that the pump motor continues to run and using a DC voltmeter, check the voltage drop of each battery individually. See figure 6-4.

5. Meter should read 12VDC ± 1VDC.

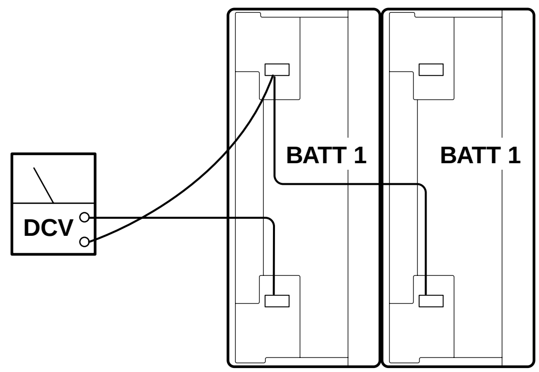


Figure 6-4.

6-4. Batteries

The BATTERY operating mode is powered by two 12 volt batteries connected in series to provide the 24 volt operating power.

The battery system voltage should be 24VDC at a range of 22VDC to 26VDC. If the battery charge level falls below 23.5 volts the BATTERY operation indicator on the pendant control will blink indicating that the batteries require recharging. The built-in charging system automatically keeps the batteries at the proper charge level when the AC120V operating mode is ON. The charging system will operate while the table is being operated in the AC120V mode.

a. Battery System Test

1. Disconnect the main power cord and using a DC voltmeter, test each individual battery at its terminals. Meter should read 12VDC ± 1V.

2. To accurately test the batteries, they must be tested under a full load. Disconnect the main power cord and make sure all other connectors are connected.

3. Turn BATTERY power ON and elevate the table to its full up position.

b. Test Results

A reading of 11 volts or below indicates the battery needs charging.

After batteries have been fully charged, repeat the full load test. If either battery's voltage drops below 11VDC it should be replaced.

6-5. Battery Charging Box/AC120V Transformer

The Battery Charging Box contains the battery charging system as well as the components for AC120V operation (except the transformer).

a. Transformer Test

1. Confirm 120VAC input at CN12 using Main Switch test in 6-3a.

2. Connect CN12, disconnect CN13 (brown and red wires) and using an AC voltmeter, test the transformer output at CN13. See figure 6-5.

3. Meter should read 22VAC.

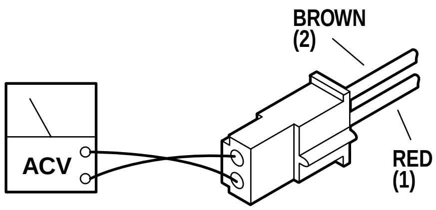


Figure 6-5. Connector CN13 Test

b. Test Results

If the correct voltage is obtained, everything is good up to this point and the problem would have to be in another area.
If you do not receive the correct measurements, the problem may be in the wires, connectors, or transformer. The transformer is located in the rear of the base under the stainless steel base cover. The stainless steel cover will have to be disconnected and lifted from the base for access to the transformer for further testing.

c. Battery Charging Box Test

1. Make sure all connectors are connected and turn AC120V operation ON. Using a DC voltmeter, test pin 3(+) and pin 4(-) of CN51. DO NOT disconnect connector CN51. See figure 6-6.

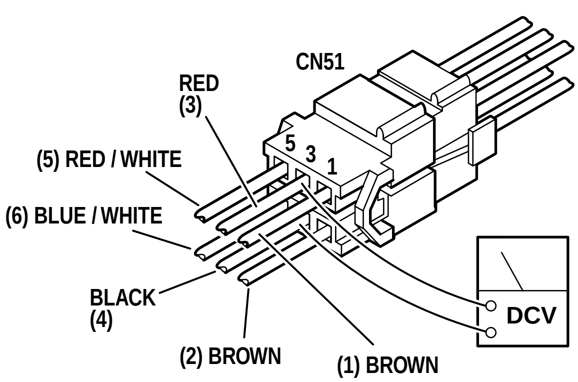


Figure 6-6. Connector CN51

2. Meter should read 26.5 ±1VDC.

3. Test pin 5(+) and pin 6(-) of CN51 with DC voltmeter to test operation of CHARGING indicator light (next to power cord connector).

4. Meter should read 26.5 ±1VDC if charger is operating. If batteries are fully charged there will be under 5 volts at pins 5 and 6.

d. Test Results

If you do not receive the correct readings, the charger system, connectors, wires, or the transformer may be defective.

e. Charging System Output Adjustment

If output reading at pins 3 and 4 is not 26.5 ± 1VDC, the output can be adjusted at the variable resistor VR-51 on the circuit board inside the Charging Box. See figure 6-7. Turn the adjuster clockwise to decrease the voltage. Counterclockwise to increase the voltage.

NOTE

The battery connectors must be disconnected to adjust the battery charger output.

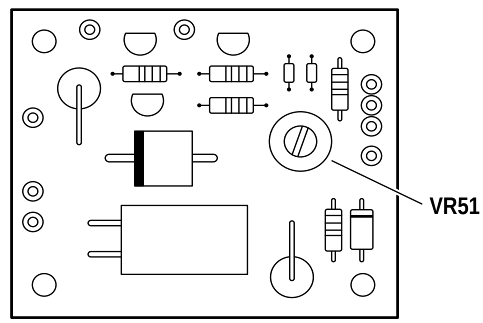


Figure 6-7

6-6. Switch-Over Relay

a. Switch-Over Relay in OFF Position

The Switch-Over Relay supplies the 24 volt input power from either the BATTERY or AC120V operating modes to the relay box for table operation. In the normal OFF position, BATTERY power is supplied to the relay box. See figure 6-8.

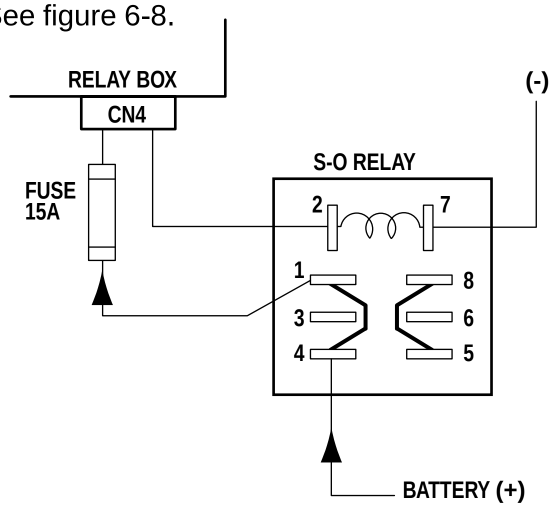


Figure 6-8. Relay in OFF Position

b. Switch-Over Relay in Activated Position

When the AC120V mode is activated by the main switch, a signal from the relay box activates the Switch-Over Relay. The relay then supplies the AC operating mode output power to the relay box and also activates the battery charging circuit. See figure 6-9.

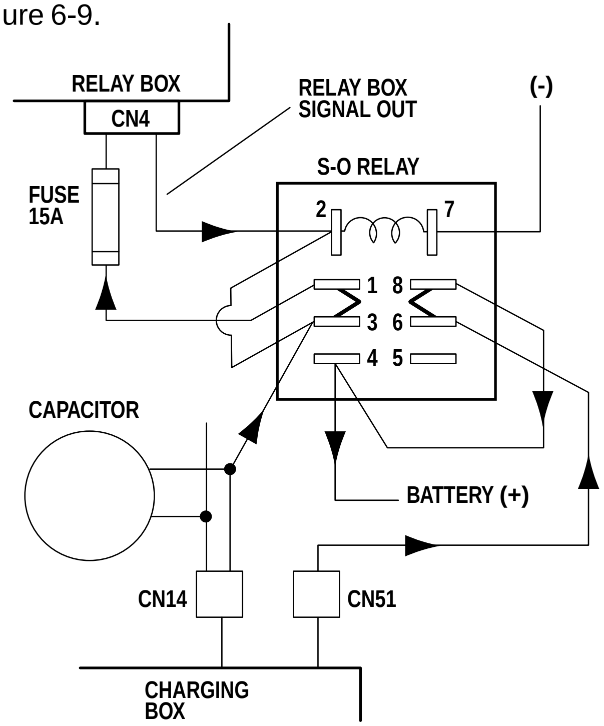


Figure 6-9. Relay in Activated Position

NOTE

The battery charging circuit is only operational when the table is in the AC120V operating mode.

c. Switch-Over Relay Test

Using a DC voltmeter, test the operation of the relay in both the OFF (AC120V - OFF) and Activated (AC120V - ON) positions. See figure 6-10.

NOTE

The Switch-Over Relay mounting block may have to be removed from the base for test access.

OFF: (AC120V - OFF)
term. 7(-) and term. 1(+) = 24 to 28VDC
term. 7(-) and term. 6(+) = 0VDC

Activated: (AC120V - ON)
term. 7(-) and term. 6(+) = 26.5±1VDC

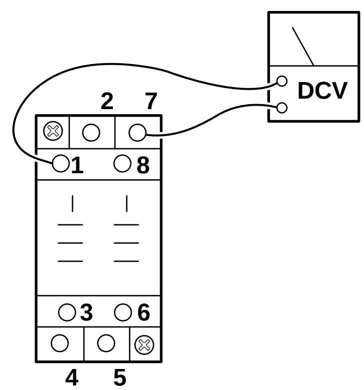


Figure 6-10. Switch-Over Relay

6-7. Pendant Control

The Pendant Control is part of the solid state, multiplex, logic control system. The pendant control contains illuminated, circuit board mounted switches and a micro processor. The encoded output from the pendant control is serial bit stream logic.

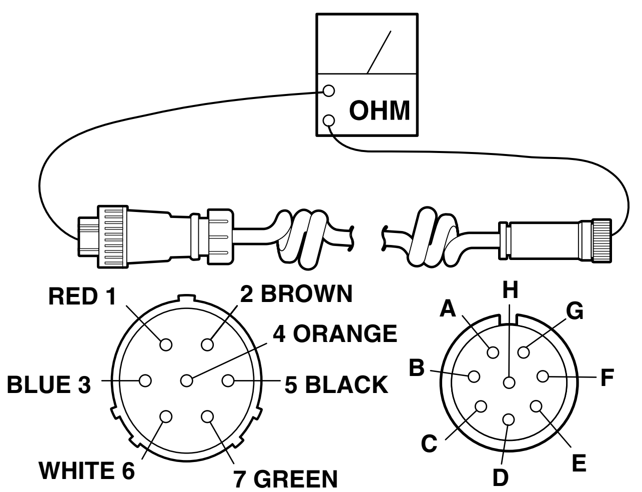
The output signal is transmitted to the micro processors in the relay box where the logic is decoded and the appropriate relays for the selected function are activated.

Pendant Control troubleshooting should begin by switching the operating mode of the table. For example; if a function fails when attempting to operate the table in the AC120V mode, switch to the BATTERY mode. If the function now operates, the problem is not the pendant control and probably is a problem located between the power cord and the relay box. If the function also fails when in battery operation, use the auxiliary switches to operate the function. If the function now operates, the problem is probably in the pendant control, connectors or wiring from the pendant control to the relay box.

a. Pendant Control Test

There are no servicable components within the Pendant Control. The cord is detachable and can be tested for continuity between the pins on the connectors. Use the following procedure to test the pendant control cord.

Disconnect the cord from the base connector and from the pendant control connector and using an ohmmeter, test the continuity between the corresponding pins in the connectors. See figure 6-11.



Test Leads			
Base Conn. Pin	Pend. Conn. Pin	Base Conn. Pin	Pend. Conn. Pin
1	A	5	E
2	B	6	F
3	C	7	G
4	D		

Figure 6-11. Pendant Control Cord Test

b. Test Results

If you do not receive the correct readings, the wiring or connector pins may be faulty.

c. Base Connector Test

If correct readings are received, test the wiring from the base connector to connector CN7 at the Relay Box. Disconnect connector CN7 from the Relay Box and using an ohmmeter, test the continuity between the corresponding pins in connectors CN7 and the base connector. See figure 6-12.

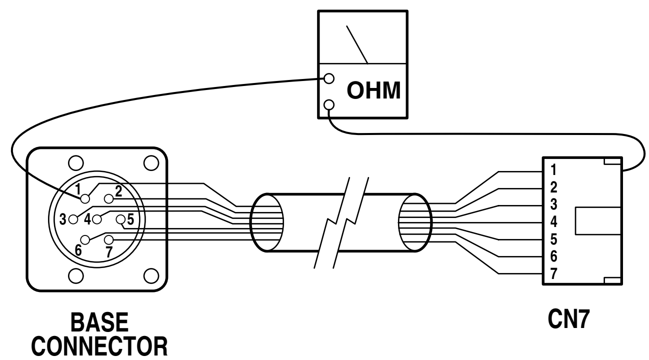


Figure 6-12. Base Connector Continuity Test

If the correct readings are obtained, this part of the circuit is okay and the problem may be Pendant Control or the Relay Box. Contact SKYTRON if all tests performed indicate that the problem is located in the Pendant Control.

6-8. Auxiliary Switches

The following tests will determine if the auxiliary switches are functioning properly.

a. Switch Test

Disconnect connector CN3 at the Relay Box and using an ohmmeter check for continuity at the connector pins (pin 1A common) while activating the appropriate switch. See figure 6-13. Meter should read 0 ohms.

b. Test Results

If proper meter readings are not received, test the individual switches as necessary. Using an ohmmeter, test the operation of an individual switch with the (+) test lead at the center terminal of the switch and the (-) test lead at the terminal opposite the direction of the switch actuation. See figure 6-14. Meter should read 0 ohms. If the switches check out, the problem would have to be in the wires or connector CN3.

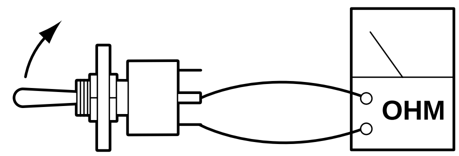


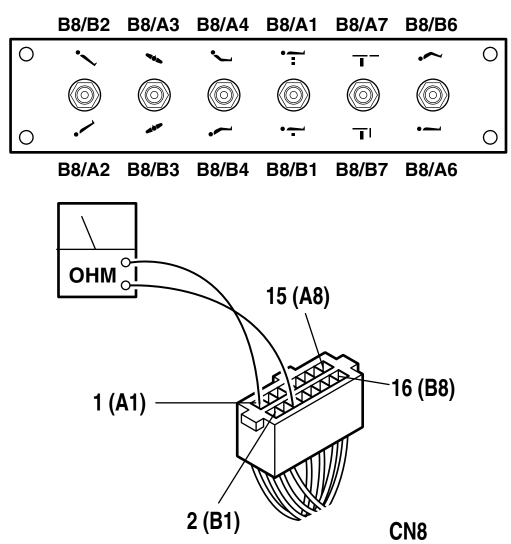
Figure 6-14. Auxiliary Switch Test

6-9. Relay Box

The power supply is directly connected to the relay contacts. When these contacts are closed, 24 volts is supplied to the solenoids which are mounted on the hydraulic mini-valves. One relay is used to supply power to the pump/motor and is always activated no matter what control function is selected. The brake locking circuit relay is also activated when any control function other than BRAKE UNLOCK is *initially* selected.

Also, inside the 3500B relay box is a step-down transformer and full-wave rectifier which decreases the voltage to 5-6 volts. This low voltage potential controls the relays by the use of the hand-held pendant control buttons. Basically the relays enable a 5-6 volt potential to control the 24 volt circuit.

The following tests will determine if the relay box is functioning correctly.



PIN NO	COLOR	PIN NO	COLOR
1 (A1)	Red	9 (A5)	--
2 (B1)	White/Red	10 (B5)	--
3 (A2)	Brown	11 (A6)	White/Purple
4 (B2)	Yellow	12 (B6)	Purple
5 (A3)	Orange	13 (A7)	Grey
6 (B3)	White/Orange	14 (B7)	White/Grey
7 (A4)	White/Brown	15 (A8)	Red/White
8 (B4)	Blue/White	16 (B8)	Pink

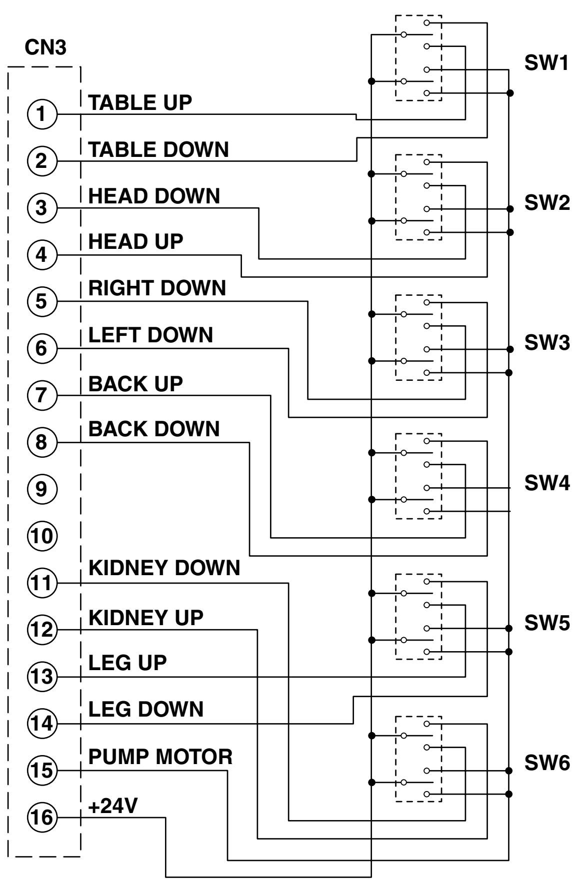


Figure 6-13. Auxiliary Switch Connector CN3

a. Checking Relay Box Input Power

1. Connect power cord to table. Plug the power cord into the 120VAC supply (wall receptacle). Disconnect connector CN4, leave all other connectors connected.

2. Using a DC voltmeter, test input power for both the BATTERY and AC120V operating modes. See figure 6-15. Meter should read approximately 24 -28 volts.

BATTERY mode	AC120V mode
(Main Power OFF)	(Main Power ON)
pin1=(+)	pin 5=(+)
pin2=(-)	pin 6=(-)

Connector CN4 Color Code

Pin 1 Red	Pin 5 White
Pin 2 Blue	Pin 6 Black
Pin 3 Yellow	Pin 7 Yellow
Pin 4 Blue	

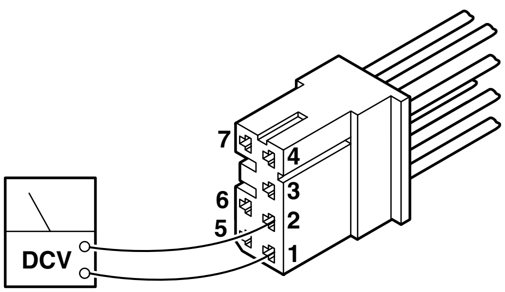


Figure 6-15. Relay Box Input

b. Test Results:

If you do not receive the correct meter readings, the problem is in the input wiring, connectors or components. If the correct readings are obtained, proceed to the next step.

c. Checking Output to Pump

1. Disconnect pump connector CN15, connect all other connectors and activate the AC120V operating mode.

2. Test CN15 at pin 1(+) and pin 2(-) with a DC voltmeter. Meter should read approximately 24-28 volts when any function button is activated. If no voltage is present, use an ohmmeter to test the continuity from CN15 to CN4 (yellow and blue wires). Refer to figure 6-15 for CN4 pin locations.

d. Checking Output to Solenoids

This test checks the voltage that is used to energize the solenoids.

1. Activate either BATTERY or AC120V operating mode.

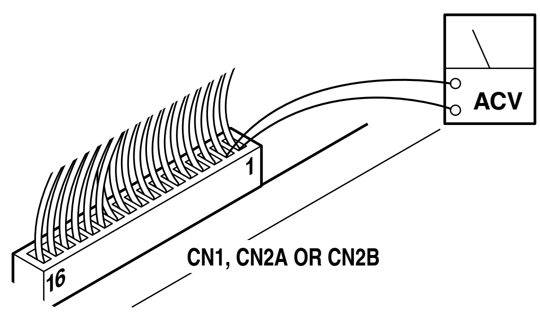
NOTE

•The Brake Lock function is activated by pressing any function button (except BRAKE UNLOCK). A timer in the Relay Box allows continuous output for about 7 seconds. If the brakes are already locked, no output is provided.

•The BRAKE UNLOCK button activates another timer in the relay box which allows continuous output for the brake release function for approximately 7 seconds. If the brakes are already released (using the BRAKE UNLOCK button) no output is provided.

2. Test connectors CN1, CN2A and CN2B from the back while attached to the relay box. All connectors should be connected.

3. Activate each of the pendant control buttons and measure the output voltage for the corresponding connector pins with a DC voltmeter. See figure 6-16. Meter should read 24 volts.



CN1 FUNCTION	CN1 PINS	CN2A FUNCTION	CN2A PINS
Table Up	1 - 2	Back Up	1 - 2
Table Down	3 - 4	Back Down	3 - 4
Trend	5 - 6	Slide Foot	5 - 6
Rev Trend	7 - 8	Slide Head	7 - 8
Tilt Right	9 - 10	Kidney Up	9 - 10
Tilt Left	11 - 12	Kidney Down	11 - 12
Reflex	13 - 14	Leg Up	13 - 14
Flex	15 - 16	Leg Down	15 - 16
		CN2B	
		Brake Set	1 - 2
		Brake Unlock	3 - 4

Figure 6-16. Solenoid Output Connectors

e. Test Results:

If you do not receive the correct meter readings, the relay box is defective and should be replaced.

NOTE

•Before deciding the relay box is defective, check the wires and pins in the connector blocks to make sure they are not loose or making a bad connection with their mate.
•If the battery power is ON and no table functions have been activated for 3 hours, the power off circuit will interrupt the battery power.

f. Checking Output to Pendant Control

The output to the Pendant Control can not be tested without specialized equipment. If all tests have been conducted and it appears that the Relay Box is faulty, contact SKYTRON.

NOTE

The Relay Box connectors CN7 (Pendant Control), and CN8 (Auxiliary Base Connector), are interchangeable.

6-10. Main Wire Harness Continuity Tests

If correct meter readings are not received in tests between components, before replacing the components, test the Main Wire Harness to be sure all connectors and wires are making a good connection.

a. CN4 to Batteries Test

1. Disconnect connectors CN4 and the (+) and (-) connectors from the batteries. Leave all other connectors connected.

2. Using an ohmmeter, test for continuity between pin 1 of CN4 and battery (+) connector. Also test between pin 2 of CN4 and battery (-) connector. See figure 6-17.

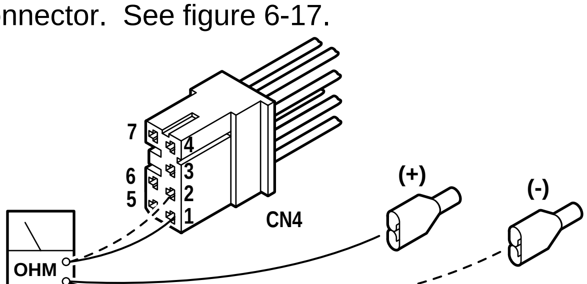


Figure 6-17.

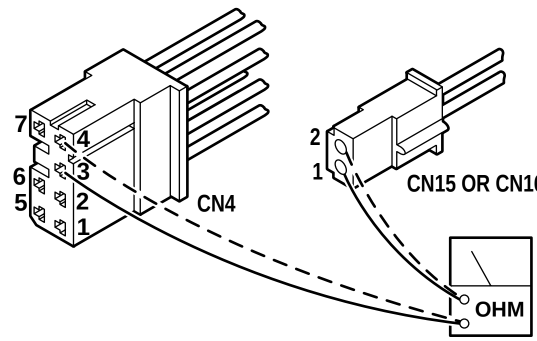
NOTE

The 15 amp battery protection fuse is in the line between CN4 pin 1 and the battery connector. Test the continuity of the fuse if correct meter reading is not received.

b. CN4 to Pump Test

1. Disconnect connectors CN4, CN15 and CN16. Leave all other connectors connected.

2. Using an ohmmeter, test for continuity between the pins of CN4 and pins on CN15 and CN16. See figure 6-18.



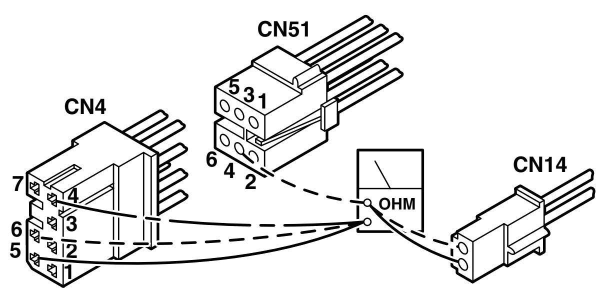
CN-4	CN-15	CN-16	OHMS
3	1		0
4	2		0
7		1	0
4		2	0

Figure 6-18.

c. CN4 to Charging Box Test

1. Disconnect connectors CN4, CN14 and CN51. Leave all other connectors connected.

2. Using an ohmmeter, test for continuity between pins 4, 5 and 6 of CN4, pins 1 and 2 of CN14, and pin 4 of CN51. See figure 6-19.



CN-14	CN-4	CN-51	OHMS
1	5		0
	6	4	0
2	4		0

Figure 6-19. CN4, CN14, and CN51

6-11. Solenoids

The solenoids are energized by 24 volt potential that is controlled by the relay box.
The solenoid windings are protected from excessive heat by an internal thermal fuse that will open after approx. 7 minutes of continuous operation. The solenoid must be replaced if the internal thermal fuse has been blown.
The solenoids are mounted directly on either side of the hydraulic mini-valves and push the spool valve in one direction or the other depending upon which solenoid is activated.

a. Solenoid Test

The following tests will check the voltage applied to the solenoids and the resistance of the solenoid coil.

b. Test #1

1. Activate either BATTERY or AC120V operating mode.
2. Disconnect the 2 pin connector from the solenoid in question, all other connectors should be connected. See figure 6-20.
3. Use a DC voltmeter and measure the voltage across the 2 pin connector. Pin 1(+), and pin 2(-). Meter should read approximately 24-28 volts.

NOTE

- The appropriate pendant control button must be pushed during this test. The motor will run when this test is performed, and the brake locking solenoid will be activated by any function other than MOVE.

- If a solenoid does not function when the pendant control button is pushed, the problem could be the pendant control, the relay box, or the solenoid.

c. Test Results:

If you do not receive the correct voltage, the problem could be in the wires leading down to the connector. The problem could also be in the relay box or the Pendant Control (refer to appropriate section for troubleshooting).

If the correct voltage is obtained, everything is good up to that point and the problem is more than likely the solenoid.

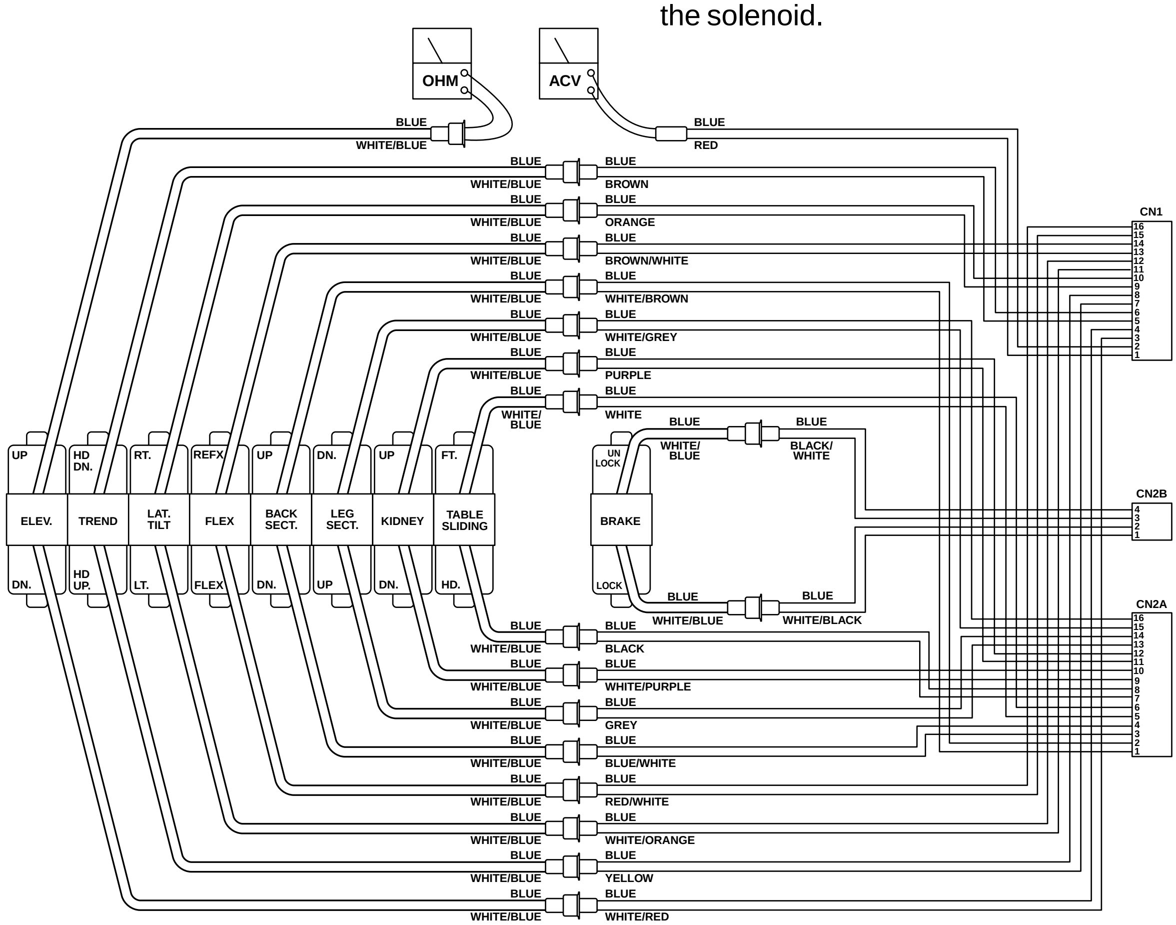


Figure 6-20. Solenoid Test

d. Test #2

The solenoid can be checked out using an ohmmeter R x 1 scale.

1. Measure the resistance between the two pin connector in question as shown in figure 6-20. Connector must be disconnected. Polarity of meter leads is not important.

2. The meter should read approximately 16 ohms at room temperature.

3. Measure the resistance between either pin and ground.

4. Meter should read infinity.

e. Test Results:

If the solenoid does not check out with the meter, it is more than likely defective and must be replaced.

NOTE

Whenever there are several components of the same type, a defective unit can also be detected by substituting a known good unit or wire connector. In some cases this may be faster than using a multi-meter.

6-12. Motor/Pump Assembly

The hydraulic pump motor is a 24 volt DC electric motor. The oil pump unit is attached to the bottom of the motor and is a gear type displacement pump with a pumping capacity of .4 liter per min. The Motor/Pump Assembly is mounted on insulators in the base of the table.

a. Motor/Pump Test

1. Disconnect motor connector CN15. Leave all other connectors connected and activate either BATTERY or AC120V operating mode.

2. Activate any function and use a DC voltmeter to measure across the two pin connector. Pin 1(+) and pin 2(-). See figure 6-21. Meter should read 24-28 volts.

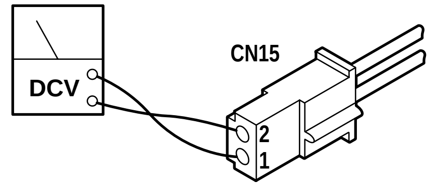


Figure 6-21. Motor Input Voltage

NOTE

If the pump has been activated continuously for 1-1/2 to 2 minutes, the thermal protector will interrupt the power to the pump.

b. Thermal Protector Test

The Thermal Protector is built in to the pump motor and is used to interrupt the current flow to the pump motor to protect it from possible damage due to overheating.

1. Turn OFF both BATTERY and AC120V operating modes.

2. Use an ohmmeter to test for continuity between terminals 1 and 2 on the connector CN16. See figure 6-22.

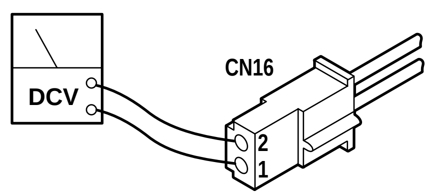


Figure 6-22. Thermal Protector

3. The Thermal Relay should reset itself after approximately one minute.

4. The Thermal Relay should activate after 1-1/2 to 2 minutes of continuous pump operation.

c. Motor Resistance Test

The motor can be statically checked for resistance using an ohmmeter. This test is not 100% accurate because you are checking the motor with very low voltage from the meter and without any load.

1. Using an ohmmeter R x 1 scale, measure the resistance between the two pins of CN15. See figure 6-22.

2. The meter should read 1 to 2 ohms at room temperature.

3. Measure the resistance between either pin and ground.

4. Meter should read infinity.

d. Test Results:

If you do not receive the correct meter readings, the motor or wiring is defective.

6-13. Return-to-Level Micro-Switches.

The return-to-level system for the Model 3500B is the same as non-battery models except for the wiring and connection to the relay box.

The return-to-level feature is activated by a single button on the pendant control and automatically levels the major table functions, lateral tilt, trendelenburg, flex, back section, and leg section.

The kidney lift has a back section-up inhibit switch to prevent the table back section from damaging the kidney lift when the lift is raised. The back section still has the capability to be lowered and raised, but will not raise more than 45° above horizontal until the kidney lift is completely down. If the back section is raised more than 45° above horizontal, the system will not allow the kidney lift to be raised.

The slide function has inhibit switches to prevent damage to the back and leg sections. If the back section is below horizontal the top will not slide toward the foot end. If the leg section is lowered more than 45° below horizontal the top will not slide toward the head end. Likewise, if the top is slid toward the foot end, the back section will not go below horizontal. If the top is slid toward the head end, the leg section will not go more than 45° below horizontal.

The return-to-level/inhibit system consists of 12 micro-switches, an electrical connector, 2 terminal strips and the related wiring. The micro-switches are mounted on or adjacent to the function they control and are wired for normally open or normally closed operation. The micro-switches are cam or lever actuated and can be adjusted at the individual switch mounting brackets. See figure 6-23.

The micro-switches operate on low voltage, and control the function circuits (pump/motor and appropriate solenoid valves) when activated by the pendant control RETURN button.

The micro-switches are wired to the relay box through 2 terminal strips, a riser cord and the 15 pin connector CN10. See figure 6-23 for switch location and identification.

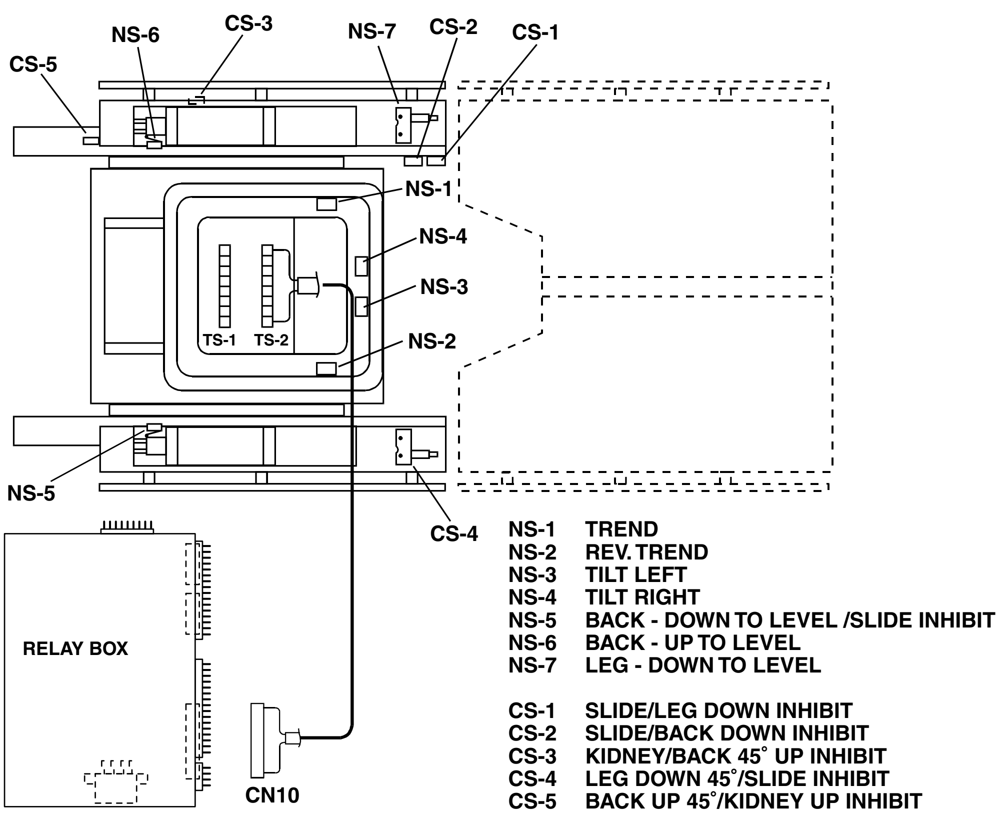


Figure 6-23.

6-14. Return/Inhibit System Troubleshooting

If a problem is suspected in the return circuits, disconnect the connector CN10 from the Relay Box to eliminate the circuits. Ensure that all table functions operate properly using the Pendant Control. If the functions do not work properly using the Pendant Control, refer to the appropriate test section and make all needed repairs before working on the return circuits.

NOTE

It is normal for the back section to move up if the RETURN button is pushed when connector CN10 is disconnected from the relay box.

All of the micro-switches are connected to the relay box via a wiring harness and the micro-switch riser cord from terminal strips 1 and 2 to connector CN10. The terminal strips are located under the hose cover on the top of the elevation column. Connector CN10 plugs into the relay box and is the most convenient location to make circuit continuity checks. See fig. 6-24 for connector pin locations.

a. Switch Test

Turn Main Power ON, lock the table brakes, and place the table top sections in a level position with the Kidney Lift down. Disconnect connector CN10 from the relay box and using an ohmmeter, test the wiring and switch operation at the appropriate pin numbers for the micro-switch in question as shown in figures 6-25 through 6-32.

NOTE

Be sure to isolate the circuit when making continuity checks.

NOTE

If you do not receive the proper continuity results at connector CN10 it does not necessarily mean the micro-switch is defective. There could be a problem with the riser cord between connector CN10 and terminal strips 1 and 2, or in the wiring from the switch to the terminal strips. Further tests will have to be made to determine the exact problem.

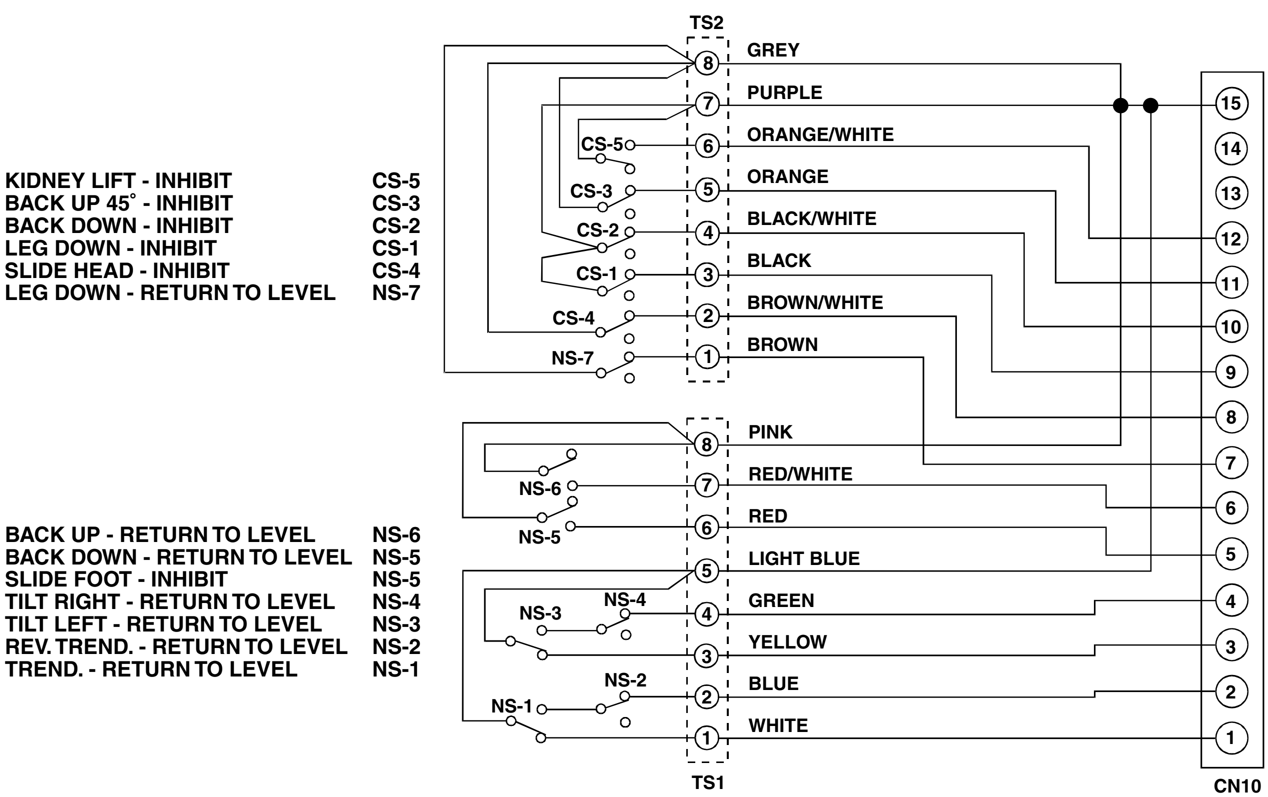
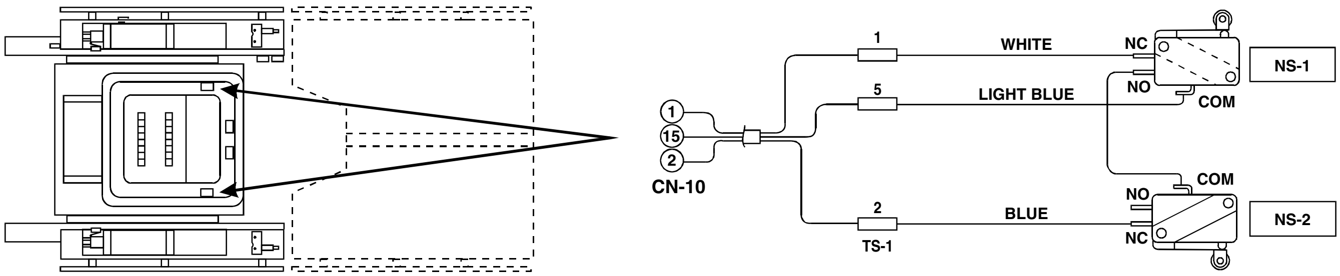


Figure 6-24. Return / Inhibit Micro-Switch Test



NS-1. Trendelenburg
Test at pins 1 & 15

Table Position	Switch Position	Meter Reading
Level Head Up Head Dn	Open Open Closed	Infinity Infinity 0

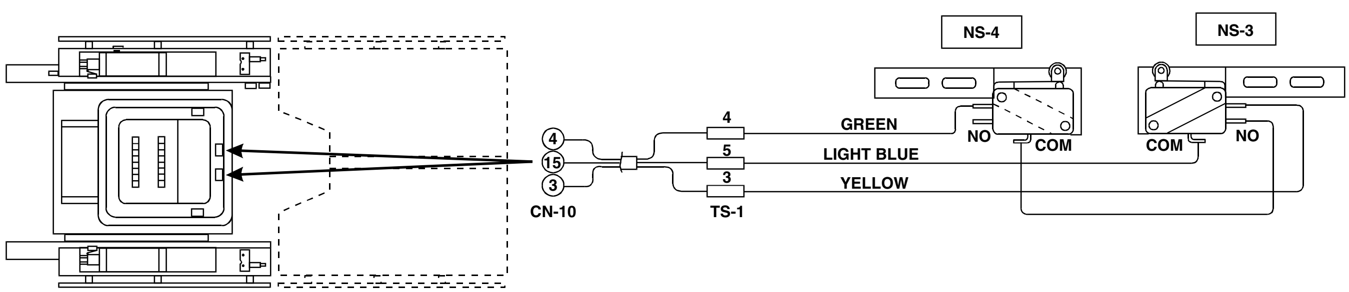
When table is in Trendelenburg Position, NS-1 brings the top back to level.

NS-2. Reverse Trendelenburg
Test at pins 2 & 15

Table Position	Switch Position	Meter Reading
Level Head Up Head Dn	Open Closed Open	Infinity 0 Infinity

When table is in Reverse Trendelenburg Position, NS-2 brings the top back to level.

Figure 6-25. Trendelenburg Return Switches



NS-3. Lateral Tilt-Left
Test at pins 3 & 15

Table Position	Switch Position	Meter Reading
Level Tilt Right Tilt Left	Open Open Closed	Infinity Infinity 0

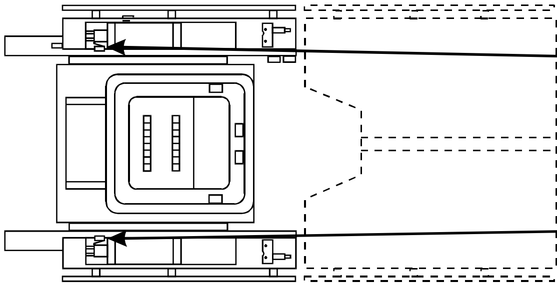
When table is inTilt-Left Position, NS-3 brings the top back to level.

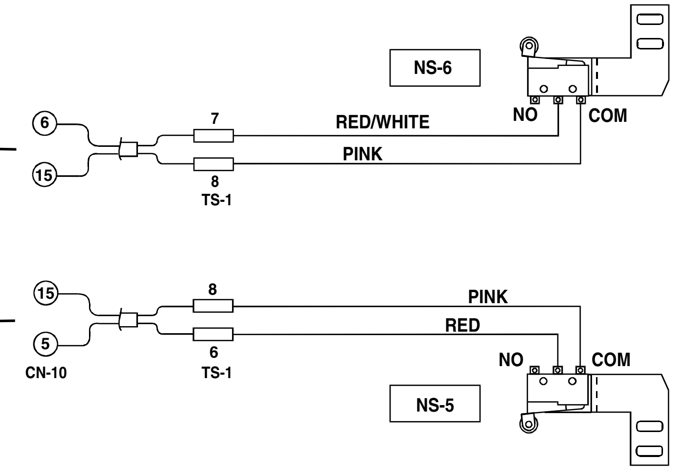
NS-4. Lateral Tilt-Right
Test at pins 4 & 15

Table Position	Switch Position	Meter Reading
Level Tilt Right Tilt Left	Open Closed Open	Infinity 0 Infinity

When table is in Tilt-Right Position, NS-4 brings the top back to level.

Figure 6-26. Lateral Tilt Return Switches





NOTE

When CN-10 is disconnected, BACK-DOWN function will not operate.

NS-5. Back Section Down
Test at pins 5 & 15

Table Position	Switch Position	Meter Reading
Level Back Dn Back Up	Closed Open Closed	0 Infinity 0

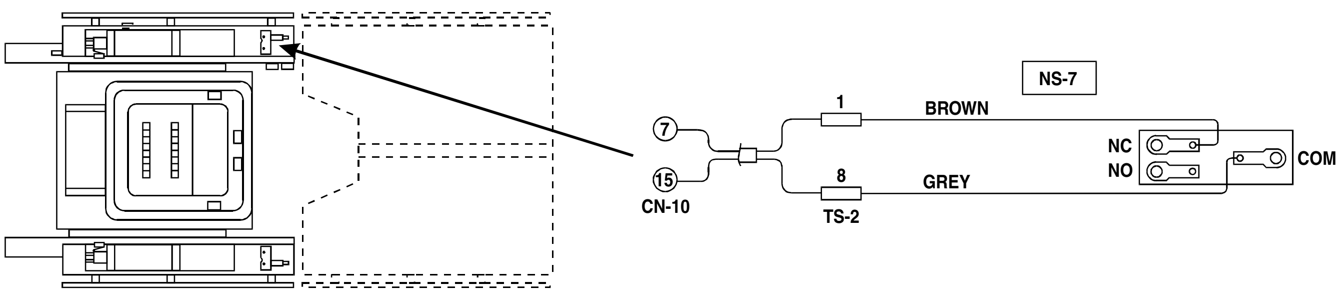
When the Back Section is Down, NS-5 brings the Back Section Up to level and will not allow Top Slide toward foot.

NS-6. Back Section Up
Test at pins 6 & 15

Table Position	Switch Position	Meter Reading
Level Back Dn Back Up	Open Open Closed	Infinity Infinity 0

When the Back Section is Up, NS-6 brings the Back Section Down to level.

Figure 6-27. Back Section Return Switches

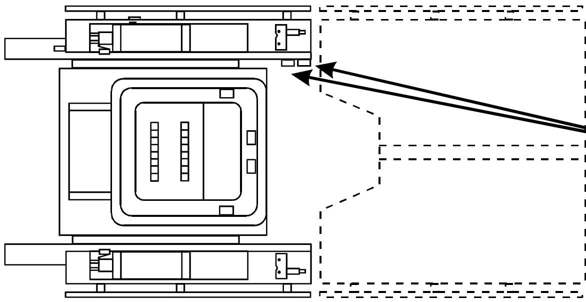


NS-7. Leg Section Down
Test at pins 7 & 15

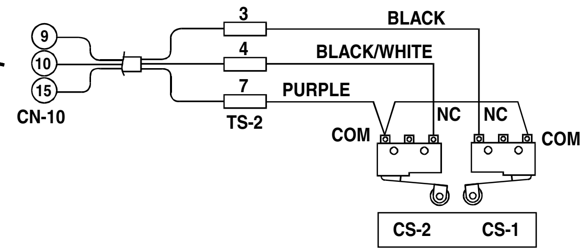
Table Position	Switch Position	Meter Reading
Level Leg Dn	Open Closed	Infinity 0

When the Leg Section is Down, NS-7 brings the Leg Section Up to level.

Figure 6-28. Leg Section Return Switches



NOTES
SLIDE function will not operate when CN-10 is disconnected.



CS-1. Leg Down 45° Inhibit
Test at pins 9 & 15

Table Position	Switch Position	Meter Reading
Center Slide Hd Slide Ft	Closed Closed Open	0 0 Infinity

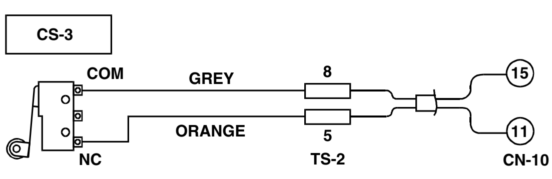
When Top is slid toward head, CS-1 will not allow Leg Section to go more than 45° below horizontal.

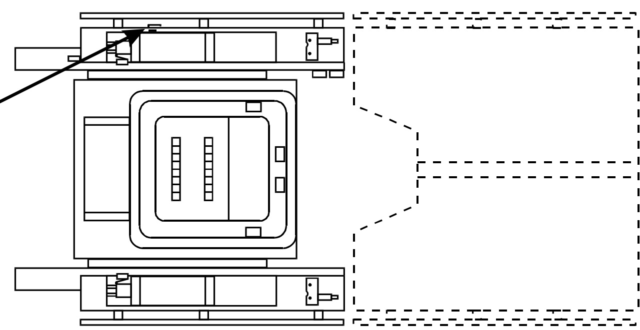
CS-2. Back Down Inhibit
Test at pins 10 & 15

Table Position	Switch Position	Meter Reading
Center Slide Hd Slide Ft	Open Closed Open	Infinity 0 Infinity

When Top is slid toward foot, CS-2 will not allow Back Section to go below horizontal.

Figure 6-29. Leg Down / Back Down Inhibit Switches





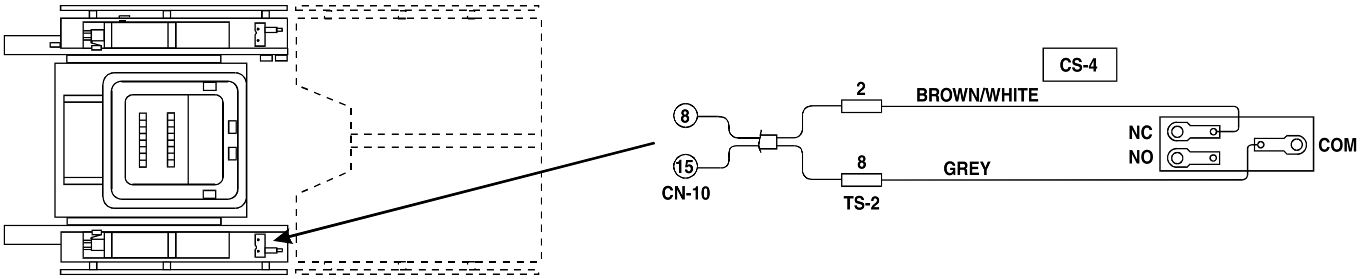
CS-3. Back Up Inhibit Switch
Test at pins 11 & 15

Table Position	Switch Position	Meter Reading
K-Lift Dn K-Lift Up	Open Closed	Infinity 0

When K-Lift is Up, CS-3 will not allow Back Section to go more than 45° above horizontal.

Figure 6-30. Back Up Inhibit Switches

3500B

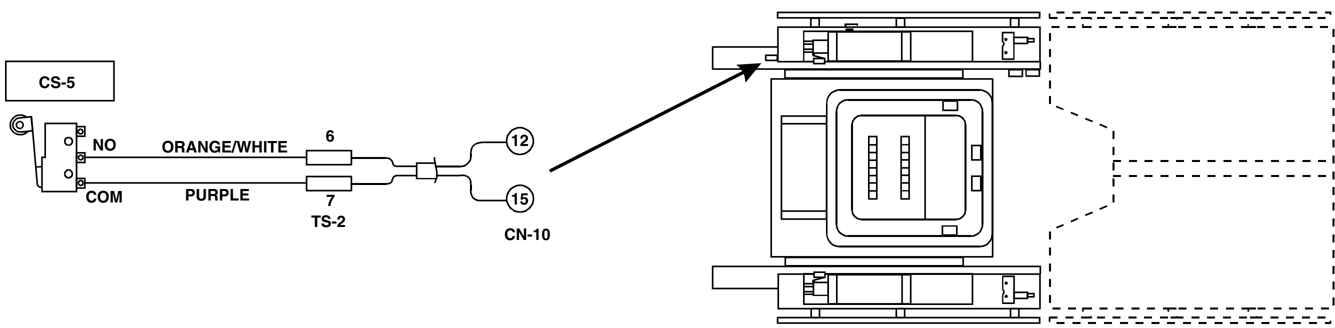


CS-4. Slide Inhibit
Test at pins 8 & 15

Table Position	Switch Position	Meter Reading
Level Leg Dn more than 45°	Open Closed	Infinity 0

When Leg Section is more than 45° below horizontal, CS-4 will not allow Top to Slide toward head.

Figure 6-31. Slide to Head Inhibit Switches



CS-5. Slide Inhibit
Test at pins 12 & 15

Table Position	Switch Position	Meter Reading
Back Up Less Than 45° Back Up More Than 45°	Open Closed	Infinity 0

When Back Section is more than 45° above horizontal, CS-5 will not allow Kidney Lift to operate.

Figure 6-32. Kidney Lift Inhibit Switches

b. Switch Adjustment.

If proper readings are not obtained during test or if table does not properly return to level, use the following procedure to adjust the switches.

1. Apply table brakes and (using a level) level the table top using the TRENDELENBURG and LATERAL-TILT function buttons on the pendant control.

2. For all switches except the Leg Section switches, carefully loosen the switch retaining screws, and adjust the switches as needed. See figure 6-33.

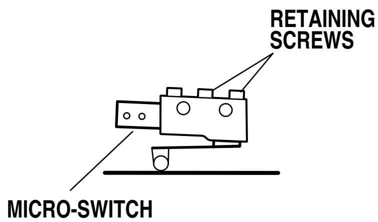


Figure 6-33. Micro-Switch Adjustment

3. To adjust the Leg Section switches loosen the jam nuts, adjust the switch, and tighten the jam nuts. See figure 6-34.

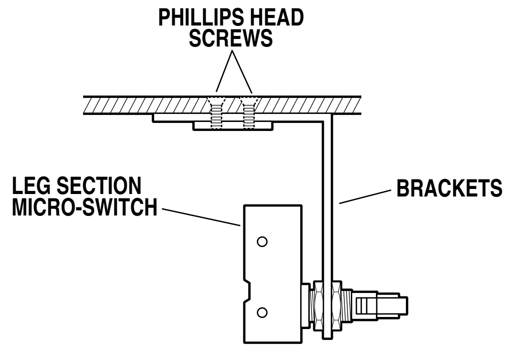


Figure 6-34. Leg Section Micro-Switch Adjustment.

7-1. Relay Box Adjustments

The Relay Box contains variable resistors for adjusting the operating timers for the BRAKE SET and BRAKE UNLOCK functions. The Relay Box for the battery model tables also has variable resistors for setting the Power Off timer and the battery recharge warning circuit. These timers are set at the factory and usually never need adjustment. If an adjustment is necessary, remove the relay box cover and use the following procedures. See figures 7-1 through 7-3.

a. Brake Release Timer

The Brake Release Timer is set for about 7 seconds and is controlled by the variable resistor VR1 on the relay box circuit board. Turn the adjuster clockwise to increase the operating time. Counterclockwise to decrease the operating time.

b. Brake Set Timer

The Brake Set Timer is set for about 7 seconds and is controlled by the variable resistor VR2 on the relay box circuit board. Turn the adjuster clockwise to increase the operating time. Counterclockwise to decrease the operating time.

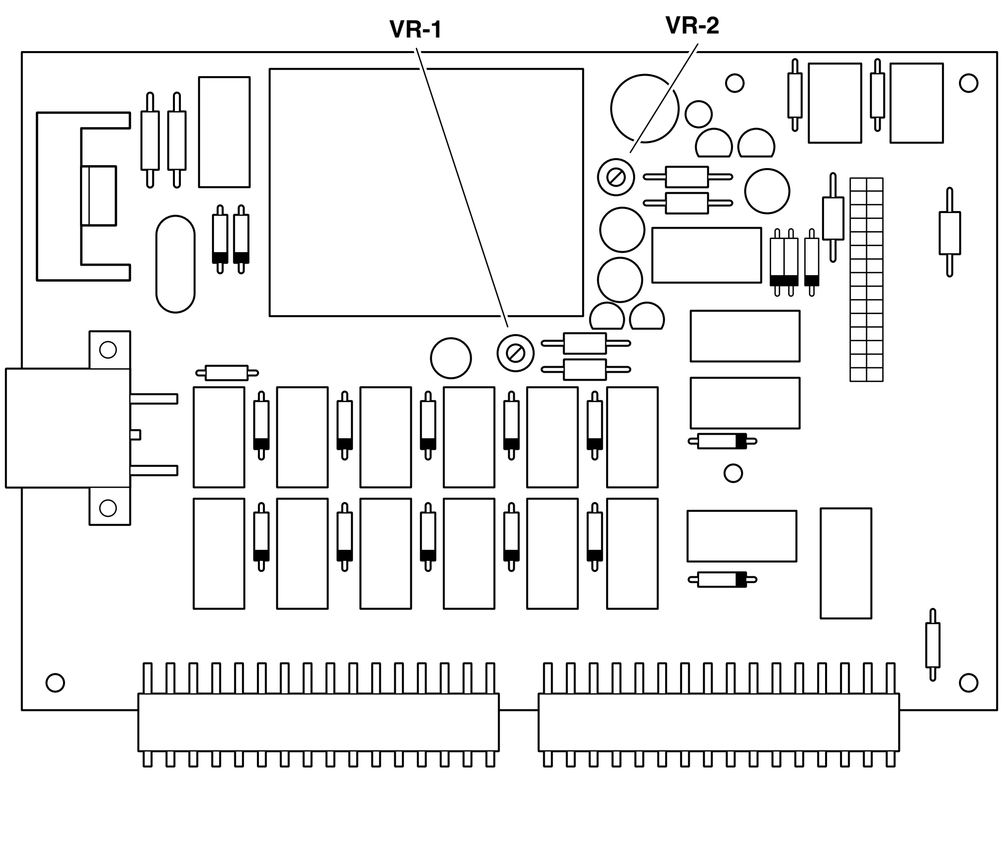


Figure 7-1. Relay Box Adjustments Model 3500

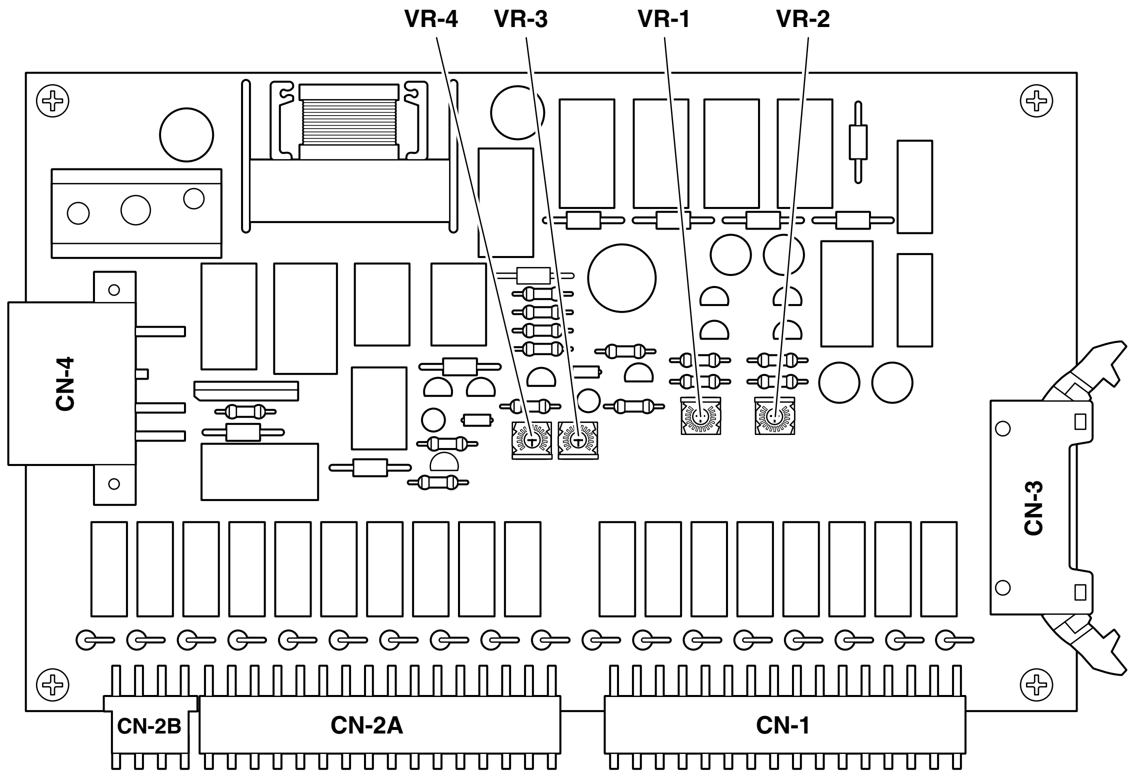
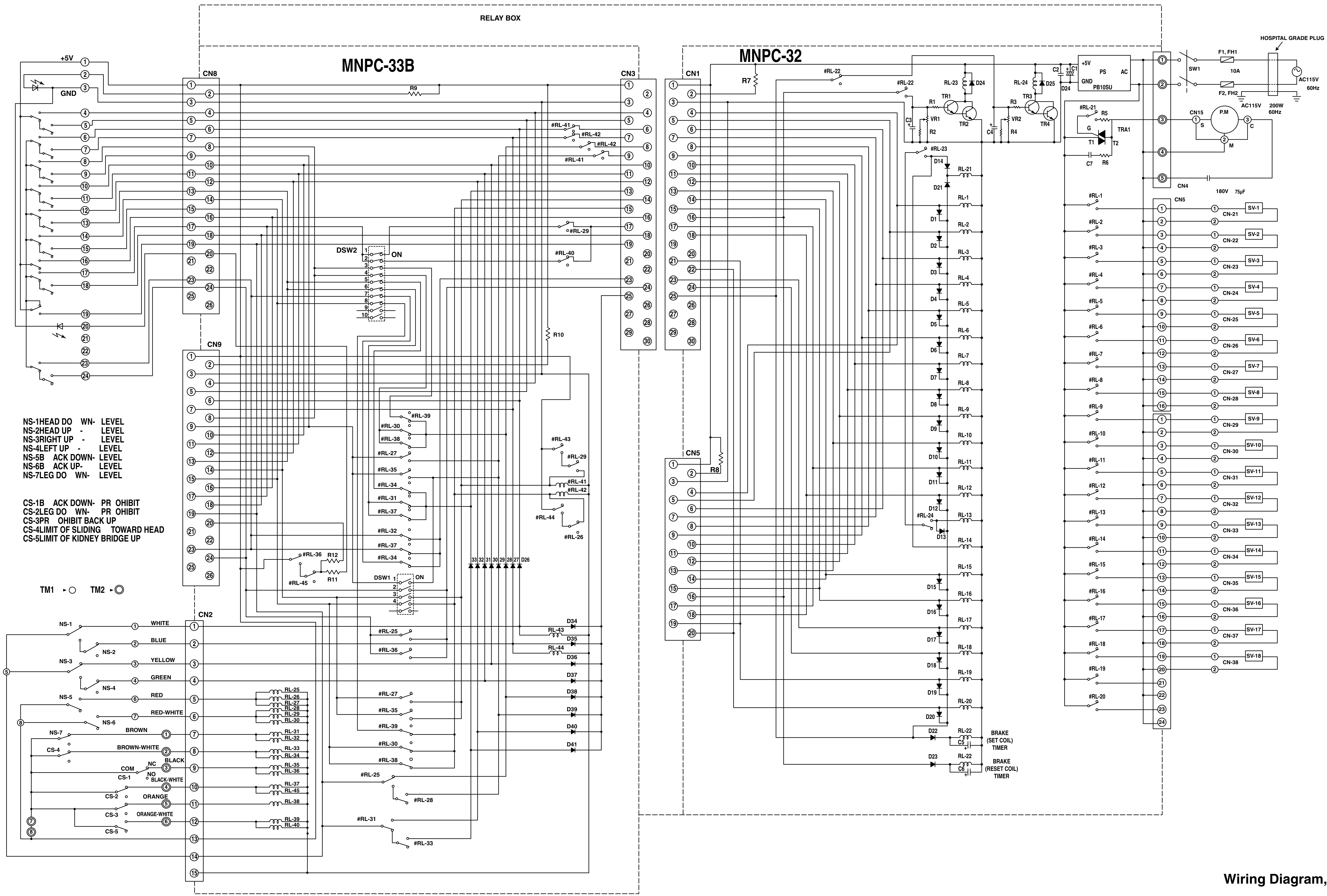
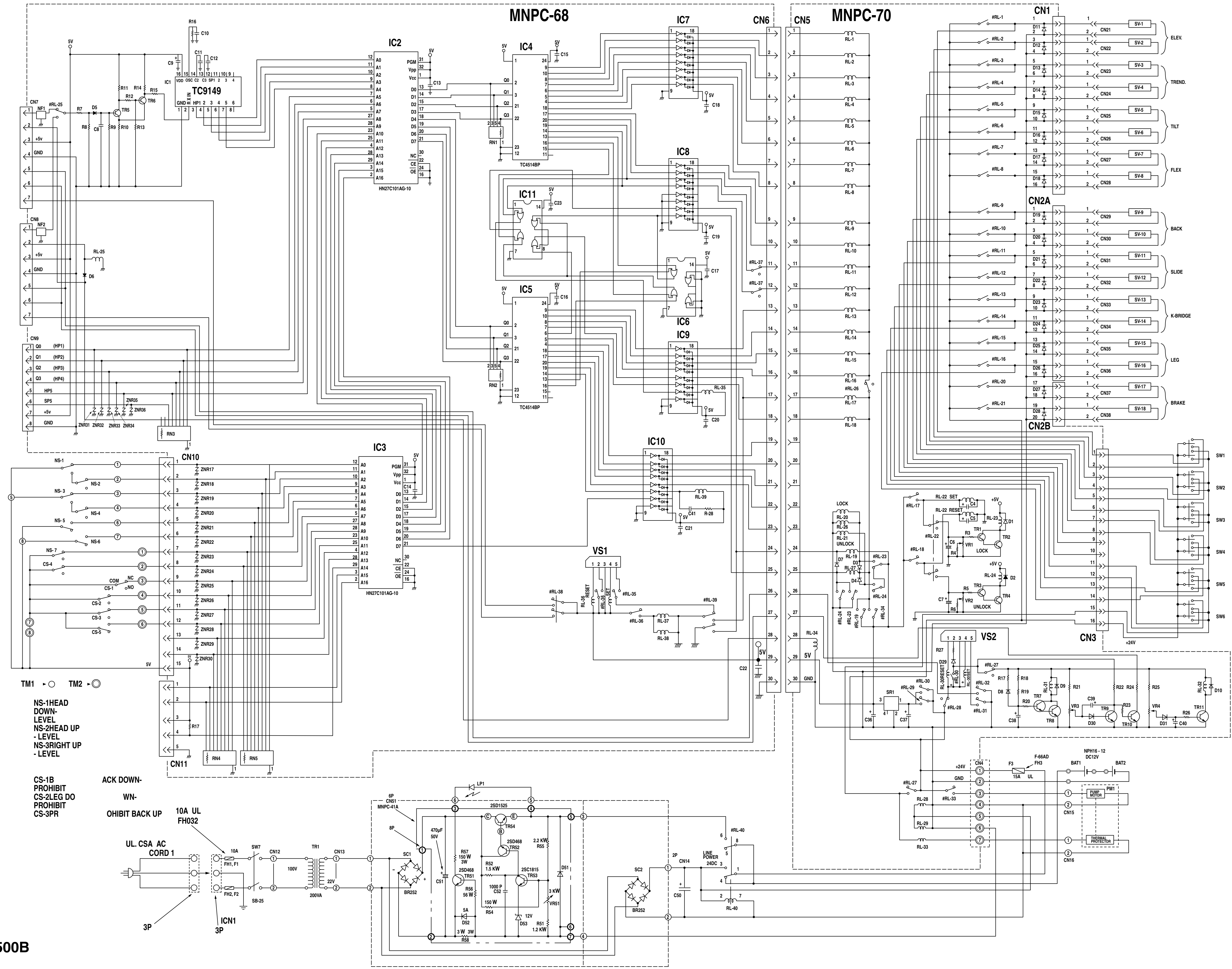


Figure 7-2. Relay Box Adjustments Model 3500B



Wiring Diagram, Model 3500



Wiring Diagram, Model 3500B

SKYTRON